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FARMERS DIGEST

MAY, 1951

Volume 15 — $2.50 a Year
Number 1 — 25¢ a Copy

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The Farmer's Digest
Published Monthly except July and September at Ambler,
Pennsylvania, by the Farmer's Digest, Inc.

25¢ a Copy *1 Year $2.50*
2 Years $4.50 *3 Years $6.50*
Canadian and Foreign Subscriptions $3.00 a Year

Entered as second-class matter at the Post Office at Ambler, Pa., July 30, 1948, under act of March 3, 1879. Additional entry at Lancaster, Pa.

822858

The Farmer's Digest

Volume 15 May, 1951 Number 1

New Hope for 20 Million Runts

Condensed from Successful Farming

Damon Catron and Dean Wolf

Iowa State College

TWENTY million scrawny runt pigs in hoglots this year will make hogs of themselves if given a feeding chance. Certain APF supplements containing antibiotics will make runt pigs snap out of their growth slump, smooth up their hair coats, put meat on their ribs, and get them on the road to profit.

That's the story 108 typical runt pigs have told us in two experiments conducted during the past two years at the Iowa Experiment Station. These results are being echoed in hoglots where farmers are facing the runt problem and doing something about it. This new hope for runt pigs has made it possible for feeders to buy up runts—pigs given up as hopeless by farmers—and feed them out for profit.

We've seen antibiotics save runt pigs you wouldn't have given a nickel for before they received antibiotics in their ration. Some pigs were in such bad shape that they couldn't have lived more than a week on an ordinary ration. On a ration including the antibiotics, the runts have gone on to make normal gains.

To give you an idea what the runt problem means to the nation's hog raisers, there's an average of 1 to 1½ runts per litter. Around 14,800,000 sows will farrow this year. That will mean around 20 million runts—pigs weighing less than 20 pounds at 56 days of age.

If you're more lenient on what you call a runt, you can nearly double that figure.

Runts cost money. They waste feed before and after they are born. Most common treatment given runts up to now has been to knock them in the head, or to feed them skim milk.

Every time you knock a runt in the head at farrowing time, you lose $5.88. If you pamper a runt along on skim milk to weaning age and then lose him, you're

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out $10.

Before antibiotics were a part of the hog-feeding picture, runt pigs were nothing to be ashamed of. You could find a few in the lots of the best hog raisers.

We had a hunch that nutrition figured in the runt problem. Research men at the Michigan Experiment Station found that injecting and feeding B vitamins increased daily gains and improved the feed efficiency of slow-growing pigs that were scouring because of a previous deficiency of B vitamins. We observed that certain APF concentrates containing antibiotics and vitamin B_{12} made little pigs catch up with the big ones.

In our first experiment, 32 pigs were sorted into 4 lots as evenly as possible on the basis of size, sex, appearance, and rations fed their mothers during gestation and lactation. The pigs were typical of runts you find on any farm. They were scroungy looking pigs with potbellies and their rear flanks tucked up. They averaged only 20 pounds at 76 days. Some of the pigs were scouring.

A basal ration was fed to all lots. It consisted of ground yellow corn, 5 per cent meat and bone scraps, soybean oil meal, 2.5 per cent dehydrated alfalfa meal, vitamin A and D_2 premix, and mineral mixture including trace minerals such as iron, copper, cobalt, manganese, zinc, and iodine.

Based on past feeding standards, we figured that the basal ration contained enough nutrients to do a good job with normal, healthy pigs. It's a better ration than many Midwest farmers are now feeding. For example, a lot of hog raisers might not have fed the vitamin A and D or trace minerals. We included them to rule out the possibility of deficiencies of those nutrients in the ration.

One lot received the basal ration alone. Another lot was fed the same ration, plus APF supplement containing vitamin B_{12}, aureomycin, and B vitamins. The APF-fed pigs gained 1½ times faster than those fed the basal ration alone.

The rate of gain of the other two lots fell between these two extremes. One lot, getting the basal ration plus skim milk twice a day, gained ⅓ faster than the pigs in Lot 1, but only half as fast as the pigs in Lot 2. Another lot of pigs getting B vitamins plus the basal ration gained half again as fast as the pigs in Lot 1, but were beaten 1.6 times by pigs in Lot 2.

From a feed-efficiency standpoint, the best bunch (Lot 2) ate only 281 pounds of feed to put on 100 pounds of pork. Poorest group (Lot 1) ate 346 pounds per 100 pounds gain.

The second experiment was set up to check the results of the

first and to find out whether it was the vitamin B_{12} or the aureomycin in the APF that resulted in the extra gains.

This time we started with 9 lots of 8 pigs each. Pigs were a little better than those in the first experiment, averaging 21 pounds at 72 days of age.

The same basal ration was fed, except that the meat and bone scraps level was raised to 10 per cent and the dehydrated alfalfa meal level to 5 per cent.

Lot 1 got the basal ration alone. Lot 2 was fed the basal plus all the pasteurized skim milk the pigs would drink twice a day; Lot 3 received the basal plus B vitamins; Lot 4, the basal plus an APF supplement containing terramycin and vitamin B_{12}, and B vitamins; Lot 5, the basal plus the same APF supplement, B vitamins, and thyroprotein; Lot 6, the basal plus the APF supplement; Lot 7, the basal plus crystalline vitamin B_{12}; Lot 8, the basal plus crystalline aureomycin; and Lot 9 the basal plus crystalline aureomycin and vitamin B_{12}.

As in the first experiment, B vitamins were injected once at the start of the test and then fed in the ration. They were injected to stimulate the appetites of some runt pigs to get them to eat.

Thyroprotein was added to make the pigs "burn" feed faster. We gave the runts the best ration we knew how to build, and then threw open the damper.

The results of the second test left no doubt but what the antibiotics did the trick. Pigs getting either terramycin contained in the APF supplement, or the crystalline aureomycin, made faster gains, and in general put on more pork with less feed.

The lot of pigs finishing on top were those in Lot 9 getting the basal ration plus aureomycin and vitamin B_{12}. These pigs made an average daily gain of 1.37 pounds per day and ate 265 pounds of feed to produce 100 pounds of pork. Those are good gains for normal pigs at the same weight and age.

The second best lot (Lot 8) that received the basal ration plus aureomycin, gained an average of 1.33 pounds per day, and required 279 pounds of feed per 100 pounds gain.

Pigs in Lot 1 receiving the basal ration gained an average of .86 pounds per day and required 308 pounds of feed to produce 100 pounds of pork.

The other 6 lots ranged between Lot 1 and Lot 8. The only exception was Lot 7 where the gains fell below Lot 1.

Here are some other facts brought out by the two experiments:

Vitamin B_{12} had little effect on daily gains. This indicates that the basal ration containing 10 per cent meat and bone scraps sup-

plied sufficient vitamin B_{12}.

Thyroprotein had no effect on rate of gain. This is evidence that these runts were not runts because they lacked thyroid gland activity.

The old home remedy of skim milk is not significantly better for runts than the basal ration. Average daily gain was less than .1 of a pound better than that produced by the basal ration alone.

Neither were the runts poor-doers because they lacked B vitamins. Addition of B vitamins to the basal ration increased daily gains by less than .1 of a pound. Apparently the 5 per cent dehydrated alfalfa meal supplied sufficient B vitamins.

Pigs getting the basal ration plus an APF supplement containing terramycin, vitamin B_{12}, and B vitamins made an average daily gain of 1.21 pounds and required 290 pounds of feed to produce 100 pounds of pork.

We think the terramycin and aureomycin will give about the same results if fed at the same level.

About the same story comes from the farmers. Rations well fortified with aureomycin, vitamin B_{12}, and other B vitamins have given new hope for runt pigs.

Tom Young, a Marion County, Iowa, farmer, ran into trouble with 33 pigs from 5 sows. Pigs were born squealers. Young describes them as the "scrawniest, most undernourished pigs I ever saw."

About the time he was ready to give up, a feed company representative came along. He pointed out that research at the Iowa Experiment Station indicated that a balanced ration well fortified with aureomycin, vitamin B_{12}, and other B vitamins might save the runts.

"I didn't believe him," Young recalls. "I'd been raising hogs and selling feed for 20 years and I haven't seen a feed yet that would help pigs like the ones I had. I figured the only thing for me to do was to knock them in the head and quit trying to raise hogs."

However, Young started self-feeding the special supplement along with shelled corn, and he had results within a month.

He put it this way: "After that one month of feeding, I had as nice a bunch of pigs as I'd ever seen. They were marketed at 6 months of age, which is very good considering the kind of pigs I started with. I lost 5 before I fed them the special supplement, but didn't lose a one after. Otherwise, no more than 4 or 5 of the pigs could have lived on the best ration available."

A taste wasn't enough for Young. He wanted more proof, so he bought 12 runty pigs weighing about 84 pounds apiece. He describes them as typical runts with

curly hair, big ears, and pot-bellies.

For the first week, he gave the runts nothing but a pig booster containing aureomycin, vitamin B_{12}, and other B vitamins. Then, he fed it along with grain. After 2½ months of feeding, the 84-pounders were marketed at an average of 226 pounds.

Prevention is much better than a cure, Young figures. Many runts are the result of a poor ration being fed to sows during gestation. He buys his gilts from a hog raiser who feeds a ration containing all the necessary vitamins and minerals.

Ralph Shivvers and Ted Ward, farmers and fat-hog buyers in Knoxville, Iowa, sort out light hogs that come in and feed them out. They started using supplement containing antibiotics to get away from enteritis which is prevalent around stockyards. They found that big hogs will scour and die within 10 days after opening the gates and letting them wander around to pick up corn left by other pigs.

Now, pigs are penned up for a few days during which time they get nothing but a pig booster containing antibiotics. After turning the pigs out in the yards, they still have access to pig booster in their sleeping pens. Ward and Shivvers new feed out light pigs free of enteritis.

One day they got a bunch of pigs that included 10 weighing no more than 134 pounds each. The trucker said the farmer had some more like them he wanted to get rid of. Shivvers figured as long as they had 10 they might just as well buy the rest. The farmer told Shivvers that he had given them up. He even advised against Shivvers' buying the pigs because he had tried everything to help them. But, Shivvers was set on seeing how the antibiotics would affect them.

The pigs averaged 90 pounds when Shivvers bought them. After feeding them 4 weeks on the special ration, Shivvers and Ward weighed them and they had averaged 1½ pounds gain per day.

Now to apply this information to your hoglot. You too, can save runts and put hustle into slow-growing pigs. First of all, let's find out what makes a runt.

Poor breeding stock may be a factor. A pig may not have the genetic make-up (inherited ability) to grow fast.

Poor nutrition might cause the trouble. If the mother wasn't fed right while pregnant, some pigs will end up too small and weak to get their share of milk.

Disease, such as gastro enteritis, can also stunt a pig. It can strike even a well-fed and properly managed pig. Even if it recovers, chances are it will be a runt.

Poor management is another runt-maker. A healthy pig may

become a runt if its mother is turned in with too many other sows. This is especially true if there is a big difference in the ages of the litters. Too, the young pigs pick up roundworm eggs, and mange from the adults.

Disease, brought on by deficient ration, and poor nutrition account for about 50 per cent of all runts. Prevention is still the best cure, but in spite of the best breeding, gestation feeding, and management program, you're still going to end up with a few runts. They'll have a chance if an APF supplement containing antibiotics is included in their ration.

A Study of Acetonemia

Condensed from the Holstein-Friesian World

Dr. E. S. Harrison

ACETONEMIA is an ailment that occurs in well-nourished high-producing cows. It is not an infectious disease and therefore is not transmitted from one cow to another. The cause is not definitely known but is thought to be tied up with a deranged metabolism. Studies of acetomenia cases have revealed that there is a marked drop in the sugar content of the blood. The presence of excessive quantities of acetone in the blood and urine is regarded as a secondary condition resulting from incomplete fat oxidation. It has long been recognized that the fats burn in the flame of the carbohydrates. With normal metabolism the fats are oxidized to carbon dioxide and water. With acetonemia carbohydrate metabolism is reduced to such a degree that the fats are not oxidized beyond the acetone stage. In this respect acetonemia is not like diabetes. In a human diabetes the body is unable to burn sugar because of a lack of insulin. In the absence of carbohydrate metabolism the oxidation of fats is not completed, resulting in a great increase in the acetones in the blood. The one essential difference between the two ailments is that in diabetes the body is unable to use the sugar and in acetonemia the trouble is brought on by a lack of sugar.

The clinical symptoms of digestive acetonemia, the most common form, are easily recognized. From 10 days to 6 weeks after calving there is a sudden loss of appetite, a sharp decline in milk flow and a very rapid loss of flesh. Frequently the animal stands with the back arched, the ears and head are lowered and there is a

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Laconia, N. Y., February 3, 1951

lifeless expression. The diagnosis can be confirmed by testing the urine or milk for acetones.

With the nervous type in addition to the symptoms described under the digestive type there are varying degrees of nervous disorder. The cow may be found walking in circles, pressing forward in the stanchions or the head jammed tightly against the wall of her pen. The skin becomes very sensitive, there is a wild expression in the eyes and she is easily excited. Both forms respond to the same treatment but recovery is usually somewhat slower with the nervous type.

A high percent of the cases occur from 10 days to 6 weeks after calving. Occasionally it occurs at the time of calving and explains why certain cows fail to respond to the milk fever treatment. While most of the cases occur early in the lactation isolated cases have been reported in cows late in their lactation period.

Acetonemia, unlike milk fever, occurs in cows of all ages and no particular age group appears to be more susceptible than another. I have observed, however, that certain cows appear to be more predisposed to it than others. In other words if a cow has acetonemia in one lactation she is almost certain to have it in subsequent lactations. From my experience I have also reached the conclusion that this predisposed factor follows through whole families. In the same herd and during the same period the incidence of acetonemia is frequently much higher among the daughters of one bull than it is with the daughters of another bull. I have also observed this predisposed acetonemia tendency to pass down through as many as three generations of females. This may explain why acetonemia is such a serious problem in one herd and almost unknown in another.

Acetonemia has been reported in every month of the year and the conclusion has been drawn from this fact that it is not a seasonal problem. From our experience here at Harden Farms I cannot concur in this conclusion. For the past five years the incidence of acetonemia has followed a very definite pattern. From May through December we have had only the occasional case and these have not been severe. Beginning in January and continuing until we turn the herd to pasture 25 to 40 percent of the cows calving during this period have acetonemia.

In 1948 we had some 16 cows and heifers calve between January 15 and February 20 and 12 of them came down with acetonemia from two to four weeks after calving. They stopped eating, rapidly lost condition and dropped as much as 50% in milk flow. The urine gave a strong reaction to

the test for acetones. They responded to intravenous injections of dextrose. The more severe cases required the administration of 500 c.c. of a 50% dextrose solution twice daily for a period of from 6 to 10 days. As they regained their appetite there was a marked recovery in milk production but none of them reached their expected production level. Their loss of condition resulted in a more rapid than normal decline in milk flow. There was no accurate basis upon which to estimate the cost but this I am sure of—add the cost of the sugar, the labor of administering it, the loss of milk during the attack and the lower production for the remainder of the lactation and the figure would be startling.

In February of 1949 a 3-year-old heifer calved that looked ready to go. Our faith in her seemed well grounded because she quickly reached the can of milk a day mark. Then acetonemia struck. She failed to respond to large doses of dextrose. Symptoms began to appear that indicated she was affected with the nervous type. Her skin became very sensitive and she showed evidence of great pain whenever the needle was inserted to administer the sugar. She would stand for hours in the corner of her pen with her nose pressed into the drinking cup though she made no effort to drink.

About a week after she had developed acetonemia I noticed that her fecal material had the repulsive odor of partially digested food. I called our veterinarian, Dr. John K. Boshart, and suggested that since conventional treatments had failed that she be given a moderate dose of salts. Accordingly he dissolved two pounds of magnesium sulfate in about six quarts of warm water to be given with a stomach tube. He added two ounces of crystalline choral hydrate with the hopes of quieting her before attempting to give a bottle of dextrose. Keep in mind that previously this cow had been given no less than twelve 500 c.c. bottles of dextrose with no evident improvement in her condition. Within 24 hours after receiving the magnesium salts, the chloral hydrate and sugar she began to eat. Her physical condition improved, the milk flow increased rapidly and the urine no longer reacted to the acetonemia test.

In March of 1949 we started a four year old on test that had made a very good three year old record. Within ten days after calving she was milking from 70 to 72 pounds a day. Her appetite was strong and she appeared normal in every way but she failed to gain in production as expected. We tested her urine and found a strong acetonemia reaction. She was given the mag-

nesium salts, choral hydrate and sugar treatment. The results were amazing There was a rapid increase in production until she reached a peak of 95 pounds. There was no recurrence of the acetonemia reaction and she completed a record of 821 lbs. of fat.

This case raised a very important question. Was the onset of acetonemia as sudden as previously thought or was there a gradual accumulation of acetones until a toxic level was reached when the clinical symptoms appeared? With this thought in mind we began to test the urine of all our fresh cows. We found a number of reactions and promptly treated them. The results obtained changed the whole acetonemia picture in our herd. A few case histories will serve to illustrate the importance of early diagnosis:

Case No. 1—a three-year-old fresh 14 days—milking up to 79 pounds—dropped suddenly to 70 pounds and reacted to the acetonemia test—was treated—milked 78 pounds the day after the treatment and within 10 days reached a top of 96.8.

Case No. 2—an 8-year-old cow milking up to 94.6 dropped suddenly to 81.6—reacted—treated—milked 90.5 the day following treatment and three days later milked 96.4.

Case No. 3—a three-year-old fresh 13 days milking 76.8 dropped suddenly to 62.5—reacted—treated—milked 78.2 the day following treatment and 7 days later produced 91.3.

There is no doubt in my mind that early diagnosis and prompt treatment prevented these cases from following the usual pattern. These cows never stopped eating, there was no apparent loss of condition and no lasting effect upon milk production.

Dr. Boshart then took the combination treatment and his new approach to the acetonemia problem to the field with highly satisfactory results. Whenever he was called as soon as the first clinical symptoms appeared the treatment resulted in rapid recovery. His experience over a widely scattered practice proved that we were not dealing with an individual herd problem.

All too frequently Dr. Boshart, as is the case with many other veterinarians, was not called until all home remedies had failed. In these cases the loss of appetite resulting from the acetonemia had brought on a condition of starvation. Whenever this condition existed it was necessary to treat the patient for starvation as well as acetonemia. He found that in addition to the acetonemia treatment already described forced feeding corn sugar, flour, molasses and milk with a stomach tube resulted in a more rapid recovery. The word "recovery" is probably

not the right word to use because the acetonemia and starvation had already seriously affected production for the remainder of the lactation.

The manner in which acetonemia cows responded when given magnesium sulfate suggested that a magnesium deficiency could be a contributing factor. This question was given greater significance by the fact that we knew we were dealing with a magnesium deficiency in our soil. With the help of Dr. Paul Newman of the Beacon Milling Company, a feed was prepared that would supply the equivalent of two ounces of magnesium sulfate daily to the ration. The plan was to feed this special ration during the dry period and for several weeks after calving. The addition of magnesium made the ration so unpalatable that a large percent of the cows refused it and the project was discontinued without finding the answer. The question, however, still exists and should receive the attention of the research worker.

The direct cause of acetonemia is unknown. Until the cause is known and we are able to feed our cows so as prevent the occurrence of acetonemia we must learn to live with it. The best way to live with it is to keep ahead of it. Since March 1949 when we began to systematically test the urine of the fresh cows and especially any cow with an unexplained drop in production we have not had one cow miss a feed as a result of acetonemia. This is just another way of saying that during this period the productive efficiency of our herd has not been affected by acetonemia.

Acetonemia test tablets are now available. Anyone can make the test. You simply pour a few drops of urine on one of these small concave tablets and watch for a color change. A purple color indicates a positive test, and the more rapid the color change the more severe is the acetonemia. A urine sample can usually be obtained by placing the flat of the hand about eight inches directly below the vulva and briskly stroking upward. The best time to collect is after the cow has been lying down and undisturbed for some time. If she does not respond after a short period of massage step away from her for a few minutes and then try again. If this fails try pouring a cup of water at about body temperature slowly over the vulva and follow immediately with massage.

In summary here are the facts as I see them. In the past acetonemia has lowered the productive efficiency of many cows but it need not be so in the future. The onset is not sudden for there is a gradual accumulation of the acetones in the blood which are in turn found in the urine. When a toxic level is reached clinical

symptoms appear, namely the loss of appetite, rapid loss of condition and decreased milk flow. There is some evidence that suggests that the failure of many cows to gain in milk flow and reach the expected productive level is the result of acetonemia that does not become severe enough to manifest itself by the clinical symptoms. Acetonemia has been produced experimentally by starvation. Therefore if acetonemia is not discovered until a cow has stopped eating the starvation resulting is like adding fuel to a fire. The urine test for acetones provides a simple and reliable means of discovering acetonemia before it does any material damage. This test has enabled us to control acetonemia for the past two years and our herd average and individual cow records indicate how worthwhile this has been.

Shots That Save Lambs

Condensed from The Farm Journal

KEEPING a new-born lamb alive—once he has gotten off to a poor start—is about as hard as lighting a match in a high wind.

But a sheep ranchman from Idaho, Robert Naylor of Gem County, has figured out a way to save lambs, that may be a boon to the whole range sheep industry. It's as simple as injecting a syringe-ful of quick energy sugar solution into the pocket under the lamb's front shoulder.

Naylor came across his idea one night while worrying about the dozens of things that can set lambs back in the critical first few hours after they are born. His thoughts turned to hospitals and how human patients are speeded to recovery by being fed a sugar solution through their veins. Maybe this would work under the skin for lambs.

Naylor checked the idea with a couple of doctors, and decided to try it.

He bought some regular 5% dextrose in normal saline solution —the same kind that's used in hospitals. With a hypo syringe in hand he went to the bunk house one evening, and asked to see the weakest lamb in camp. They brought it in and laid in out on the floor.

That lamb looked as if only a miracle could keep it alive another hour. Naylor inserted his

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Philadelphia, Pennsylvania, March 1951

needle in the space under the lamb's left shoulder, where the skin is free of wool and very loose, and forced in 60 cc's of solution.

The next morning he returned to the lambing shed and asked foreman Demaso Amesti: "Did our lamb die?"

"Boss," replied Amesti. "Believe it or not, that lamb is up sucking her mother!"

The same lamb later went in the lead band of sheep.

Naylor used 70,000 cc's of the sugar solution on his ranch last year, enough to give more than 1,000 treatments. He plans to use even more this year. By buying the solution eight cases at a time, he holds the cost down to only five cents a treatment.

"I can't say by actual count how many lambs this saved for us last year," says Naylor, "but I do know that we got remarkable results—and didn't lose a single lamb that was treated properly." Even dysentery sometimes dried up.

Naylor had a blacksmith make a movable stand which fits on top of gates or pen panels. That way two men can take the rig and move right through sheds and outside pens, injecting any lambs that need a boost. The two men can easily feed a hundred lambs an hour.

The lamb is never away from its mother more than 30 seconds while it's being treated. And there's little pain to the lamb. Nature put the loose skin there, and the space can be filled with no harm.

Naylor points out that it's no trick at all to rig up the equipment. A homemade bottle holder will hold the saline solution of 5% dextrose in place. All you need, then, is a drip indicator, and tubing attached to a self-filling syringe, and a No. 19 veterinary needle.

Veterinarians or surgical supply houses will sell you the supplies, and teach you how to use them and keep them sterile. Naylor warms the solution to between 90° and 100°, and gives 10 cc's per pound of lamb.

"What this man is doing is good sound treatment," says Dr. John D. Beck, veterinarian at the University of Pennsylvania. "I haven't heard of it being used for lambs before, but the principle is used right along in veterinary medicine, particularly with new-born calves. I don't see why it wouldn't work just as well with lambs.

"I'd give this warning, though: the farmer should know what he's doing, and he should use good judgment. He should talk to a veterinarian about how to do the job."

Better Pasture For Pullets

Condensed from Poultry Tribune

D. C. Kennard
Ohio Agricultural Experiment Station

NO COMBINATION quite equals that of a good range and pasture plus a simple ration of grain, protein, and minerals for growing high quality pullets after the first 8 to 10 weeks of age.

A range and pasture often may call for quite different considerations. For example, there may be good pasture near the premises of older chickens which might be carrying disease and parasites, but it would be a poor range because of contaminated soil and the association of growing chickens with the older birds. If a choice must be made between a good range and poor pasture and a questionable range with good pasture, it is more important to have the good range.

The choice of a forage is determined largely by the soil and climatic conditions. In some sections, the forage must be resistant to drouth and summer heat. In other areas, it must withstand unfavorable winter conditions.

Among the forages which are adaptable to a wide range of soil and climatic conditions are: Ladino clover, red clover, alfalfa, dwarf essex rape, bluegrass, birdsfoot trefoil, smooth bromegrass, Italian and domestic rye-grass, Sudan grass, and the cereal grasses. Information on the forage crops best suited for your locality and how to raise them can be obtained from your county agricultural agent or local vocational agriculture teacher.

Ladino clover is, undoubtedly, the preferred forage for poultry where soil and climatic conditions are favorable. Ladino can be clipped when necessary; it is highly palatable; and, what is more, it carries a high protein content throughout the growing season.

A good range and pasture will provide all of the vitamins and a part of the proteins for growth of chickens. Even a bare range has its valuable contributions, such as sunshine, fresh air, exercise, and certain minerals and vitamins made directly available to the chickens by the soil. What the range and pasture fail to provide adequately are energy as from grain; protein as from soybean oil meal, or cottonseed meal, and /or meat scraps; and minerals (phosphorus as from bone meal or

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Mount Morris, Illinois, March 1951

defluorinated rock phosphate, calcium as from oyster shell chick size, or limestone, and sodium and chlorine from common salt).

In view of what can be provided to advantage by pasture, three rations were designed by the Ohio Agricultural Experiment Station at Wooster to supplement various kinds of pasture. These rations are the product of 10 years extensive experimental work with numerous rations and methods of feeding chickens on range.

The kind of range and forage will determine the ration to be selected. If the forage is ladino clover, then either the corn and minerals or a 12 per cent protein ration will serve the purpose, because of the palatability and higher protein content of ladino.

On the other hand, if the forage is less palatable and provides less protein, then a 14 per cent ration will serve the purpose better. Likewise, the birds should receive a 14 per cent protein ration if at any time the quality of the forage deteriorates because of drouth, hot weather, or over population. Should the extreme of having the birds on a comparatively bare range become necessary, then the ration should be the same as for birds confined indoors with the exception that the Vitamin D supplement could be omitted.

In four experiments with the growth of 725 Leghorn and 2250 Rhode Island Red pullets, the birds on ladino made a consistently faster rate of growth than did similar pullets on bluegrass or run-of-farm pasture.

The Leghorns on ladino made 11 per cent greater growth with 12 per cent less feed than the pullets on bluegrass or run-of-farm ranges. Rhode Island Red pullets on ladino made 9 per cent faster growth with 12 per cent less feed than those on run-of-farm range. In one experiment, Rhode Island Red pullets on ladino that received a 12 per cent protein ration made 17 per cent more growth than similar pullets on run-of-farm pasture that received a 14 per cent protein ration. In this instance there was little difference in feed consumption.

Desirable as ladino clover may be, it is not essential. The majority of poultry raisers for various reasons will be obliged to depend on other forages. How about the feed supplements for them? A 14 per cent protein ration was the answer given to this question. In most instances this will prove to be the correct answer. And yet, the overall answer to the question is not quite so simple.

There may be circumstances whereby a poultry raiser may have occasion to use a 12 per cent protein or the corn and minerals rations to supplement other forages, especially the run-of-farm pasture. In view of the sev-

eral years of experimental results, it must be conceded that there is a place for these simple, less expensive rations to supplement forages other than ladino.

The weight of pullets that received a 12 per cent protein or corn-minerals ration on bluegrass range or run-of-farm pasture, was invariably less than that of the pullets given these rations on ladino. Also, they started to lay about two weeks later. Most poultrymen would not like this or the less pleasing appearance of the lighter pullets before they are transferred to the laying house.

However, it was after these pullets were in the laying house and received the laying ration, that they rendered a good account of themselves. They soon took on their normal weight and soon came into egg production equal to that of the pullets raised on ladino, or pullets that received more elaborate rations elsewhere. At the end of the laying year, there was little or no difference in total egg production or mortality.

A considerable number of poultrymen are so situated that range or forage is not available. For others, range or forage is impractical because of losses from predatory animals such as dogs, foxes, coons, and thievery.

Fortunately, for those who cannot raise their pullets on range, the built-up litter system can be used to raise their pullets indoors. Despite the greater costs of feeding and housing, an increasing number of poultrymen are finding the indoor procedure a solution of their problem where suitable range and pasture is either not available or where it is impracticable.

Terracing Pays

According to experiments in Wisconsin, crop yields on long slopes that have been terraced are from 10 to 15% higher than on unterraced slopes. On the basis of a 10% increase with yields of 50 bushels of corn, 50 bushels of oats, and 2½ tons of hay in a four-year rotation, this yield difference is worth $2.75 per acre per year even at very moderate prices. Morover, soil loss by erosion is considerably reduced.

The Farmer

Making Silage Can Be Easy

Condensed from Hoard's Dairyman

Professor E. L. Barger
Iowa State College

THERE is much variation the world over in methods and equipment used to make silage. In the Argentine full length bundles of green corn are laid in trenches covered over with earth and ensiled. In Iceland and the Scandinavian countries, grass silage is made without chopping. In Sweden the silo has been built within the barn at one end, under the hay track, and at the end of the barn opposite the hay door. With this system they can use a hay fork to lift full length green forage from racks, dropping it from the fork into the silo. The Swedes have also done some work with a blower designed to handle full length green grass whereby it can be blown into upright silos without chopping.

Our grandfathers made silage from corn using trenches and cutting it with a hand powered silage chopper set at the side of the trench. We have gone through a period using row binders and hand fed stationary chopper-blowers. These methods required considerable hand work. The labor requirements have been high, both as to number of man hours and as to the arduousness or difficulty of the task. The labor angle has discouraged many farmers in the making and using of silage. It has also stimulated work on the development of labor saving machines and methods. The field chopper, the forage blower, and mechanical unloading devices have done much to take the hand work out of silage making. We are reaching a point where many more farmers should be able to make silage cheaply and easily.

A few years ago time studies were made to show what the field chopper could do in the making of corn silage. The row binder, or corn binder, and stationary cutter were used and it was found that silage could be stored with about 2.0 man hours per ton. Hauling and unloading represented 32 per cent of the total labor. Following this a field chopper was substituted for the binder and a forage blower for the stationary cutter. Unloading was done by hand with silage forks. The man hours per ton were reduced to 1.2, but with this system the hauling and un-

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Fort Atkinson, Wisconsin, August 10, 1950

loading labor amounted to 86 per cent of the total. The unloading alone represented 56 per cent of the man labor required.

Following this the field chopper was used and mechanical unloading devices were substituted and the operation was completely mechanized with no hand lifting of the silage at all. With this setup the labor was reduced to .45 man hours per ton including the complete operation of chopping, hauling, unloading, and elevating the silage. In other words, the field chopper does provide a system whereby we can reduce the man labor requirements from 2.0 man hours per ton to less than a half man hour per ton, and also the labor required with this efficient method of handling is not arduous or disagreeable. In other words, we have reached a place where we can say that silage handling is truly mechanized.

It is a fundamental principle that the cost of using any machine is dependent upon the amount used. The use of the field chopper can be extended by using it to harvest field cured hay by the chopping method, by making grass and legume silage, by making corn silage, and possibly recovering straw for bedding from behind the combine. In other words, since this machine can serve to handle the entire forage crop, it is becoming more practical to own.

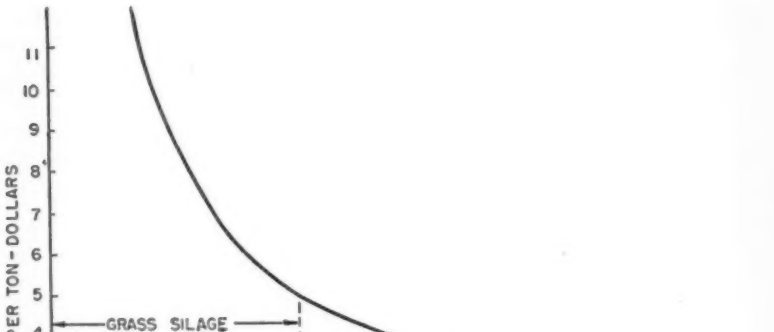
The chart below shows graphically the importance of use on the cost of operating silage-making equipment. In preparing this chart, total fixed and operating costs of the essential machines for mechanizing silage handling and labor as well have been included. The following is a list of the equipment:

1. Field chopper.
2. Tractor to power field chopper.
3. Two forage wagons (with self-unloading equipment).
4. Tractor to tow silage wagons.
5. Power operated unloading device.
6. Forage blower.
7. Tractor or engine to power forage blower.

This would be a logical line-up of equipment for permanent upright silos and for blowing chopped hay into a barn. One or more of the tractors may be from a neighbor but the cost is included.

Labor is figured at a dollar per hour.

Only the part of the total annual use of the tractor and wagons in handling the forage crop is included. All of the cost of operating the other equipment was charged against forage handling. To give a basis on which to make this example, a farm has been assumed where grass silage will be made from about 40 acres of



The descending line shows the decline in the cost of chopping and storing a ton of forage as the tons per year increase. All power, machinery, and labor costs, as well as fixed and operating costs, are included.

forage yielding approximately 150 tons. This would be the first cutting. The same 40 acres will be harvested twice as field cured chopped hay yielding about 100 tons, and 150 tons of corn silage will be made from approximately 15 acres of corn. This gives a total of 400 tons for the year.

It can be seen that the costs are reasonable when this amount of material is handled. Actually it is apparent that the cost per unit of silage handled becomes reasonably low at about the 150-ton level. It does show clearly what happens to cost of handling a ton of material with this equipment if only one of the operations is practiced. In other words, if one is to make silage with best efficiency some thought needs to be given to using the same equipment for hay chopping and extending the use of equipment out to the efficient level. Obviously this illustration does not apply to any one farm, but it does give something on which to make comparisons.

Chopping equipment can be purchased in a variety of types and prices. Choppers are available with engines mounted and they can be had with power take-off drive. One must consider, first of all, the amount of material he has to handle in making this selection. The choice of the chopper with the engine will be determined in some cases by the power

available in the tractor one has to pull the chopper. Where the tractor is light it may not have sufficient power to propel the chopper, tow a wagon, and also power the chopper mechanism. In this case a mounted engine might be necessary. Where a relatively large tractor is available, it is entirely practical to power it with a power take-off. If the chopper is to be used for chopping from the windrow, such as grass silage and field cured hay and also corn or row crop, then both the pickup and row crop attachments will be needed.

As was mentioned above, silage has been and can be made without chopping the plants at all. It is not recommended that such a practice be followed. The first and foremost object in chopping is to be able to move it in an air stream and thereby be able to mechanize the handling and moving. Chopping also facilitates packing and air exclusion and easier feeding.

One might ask how fine should silage be cut. In considering this problem one must recognize that fine cutting requires more power in the chopping operation and reduces the capacity of the chopper to a certain extent. One should also realize that with the grass and legume silages the average length of the particle will be about twice the theoretical setting of the chopper. The theoretical cut or setting is the advance in inches that the feed roll or feed apron makes between two successive knives. In other words, if a plant is moving in at right angles to the knives, it would be cut into lengths equal to the theoretical cut.

Since the grasses do not feed in straight at all times, the average length is found to be about twice the theoretical cut. One cannot say that good silage cannot be made with the longer cuts. A theoretical minimum cut of about ½" is usually short enough and even longer cuts are satisfactory. With the longer cuts attention should be given to packing and tramping the silage to exclude pockets and air within the silage.

The wagon suitable for handling chopped forages can also be the general purpose wagon on the farm. A wagon of about 7 × 14 overall dimensions and with adjustable height box to suit the crop usually meets these requirements. For grass and corn silage the sides need to be only high enough to haul a practical size load.

Under most conditions this need not be greater than three tons. In general the tires, frames, and wheels available for such wagons have a maximum capacity of about 6,000 pounds total. Higher side extensions and even a cover is desirable when handling dry chopped hay. This is a practical wagon for picking corn, fixing fence, and general farm work,

and one should not figure the total investment in such wagons as investment in hay equipment alone.

Power unloading equipment is a must if the operation is to be completely mechanized. Unloading by hand is heavy work and the capacity is limited unless three men are used to do the job. A good blower will handle 1,000 pounds per minute of green material. Even with hand-powered devices other than the pitchfork, one man cannot operate at this capacity. Tests have shown three men can unload by hand at about the capacity of the blower. Mechanical unloading devices with one man can keep the blower full to capacity.

Success With Calf Raising

Condensed from the Guernsey Breeder's Journal

Dr. H. A. Herman
University of Missouri

THE growing of dairy calves is one of the most important, yet often neglected, phases of dairy farming. By raising, rather than purchasing, breeding stock, a dairyman may bring about effective improvement in production by the use of good pure bred sires and selecting heifers only from the best producing cows. Raising heifers, rather than depending on random purchases, also makes it possible to more effectively prevent the introduction of contagious diseases such as tuberculosis, Brucellosis, and mastitis into the herd.

The maintenance of the dairy herd in numbers and established production levels requires the replacement of 20 to 30 per cent of the cattle annually. Various studies show that the average cow in the Dairy Herd Improvement Associations of this country remains in the herd from 3.6 to 4.7 years after freshening. The growing of approximately five to six million calves per year for replacement purposes is an expensive proposition for the entire dairy industry. It, likewise, is an item of no small cost to the average individual herd owner who

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must return his profits from milk production back into the business at the rate of four to six hundred dollars per year for each 10 cows he maintains, if he expects to keep his herd of constant size.

Since calf raising, and the growth of young stock, is an expensive item, it behooves every dairyman to follow those practices which insure the raising of a maximum number of calves in a manner which permits normal development, and is yet economical in feed and labor costs. All too often we find young stock undersized at freshening time, and the results in production are disappointing. In general, we might well go on the theory that if a calf is worth raising it is worth raising well. The mortality among calves is appalling, and we find many herds failing to progress, even though the best of sires are used and a production testing program is followed, because the calf crop from the best cows is lost.

The following are some of the essential features of any calf raising program:

1. Select the Calves to be Raised

Too many dairymen attempt to raise every calf. Obviously, many cows are inferior and should not be allowed to propagate their kind. It costs just about as much to raise an inferior calf as a good one. Some goal, with respect to production of the dam and predicted transmitting ability of the sire, should be established. Many practical breeders are finding the best way to cull dairy cattle is to dispose of a really poor cow and all her offspring. It is true that occasionally some of these 150–200 pound fat producers are the mothers of satisfactory producing daughters, but the failures outnumber the successes, and it is folly to invest money and time against such odds. If the goal is a 400-pound fat producing herd, the culling of calves from dams below that level must be just as vigorous as practical.

2. Feeding the Dry Cow

The raising of thrifty calves really starts before they are born. The calf makes its greatest growth before birth, during the last two or three months of gestation. Cows should have a six to eight weeks dry period and must be fed so as to be in good body flesh at calving time. The dry cow should be fed plenty of good quality green, leafy hay, as well as silage if it is available, and enough grain feed to keep her in a good thrifty condition. A varied diet for the pregnant cow is important. Cows forced to live on the poorest roughages with little green feed or grain in the diet often calve in thin condition and produce poorly. In extreme cases of poor nutrition of the dam,

calves with a lowered resistance to disease, because of a lack of sufficient vitamins in the diet, may be produced. It is a well-known fact that poor quality roughages are usually low in vitamin A and often vitamin D. Green feeds, such as pasture and silage, with a minimum feeding of grain, however, may be depended upon to make up such deficiencies, and special mineral or vitamin feeds are seldom necessary to supplement the usual diet. A good grain ration for the dry cow consists of:

	Lbs.
Ground corn, corn and cob meal, ground barley or hominy	300
Ground or crimped oats	300
Wheat bran	300
Linseed or soybean oil meal	100
Salt	10
Steamed bone meal	10

3. Starting the Calf Right—Sanitation

In many herds, eight to 10 per cent of the calves born alive die before one year of age. Severe epidemics, particularly infections or white scours and pneumonia, are more frequent and more disastrous in large herds than small. Many pure bred dairy herds have difficulty in raising enough replacements to keep the herd at optimum size. Studies at several agricultural colleges reveal that 25 to 40 per cent of death losses occur the first week after birth, and a total of 40 to 65 per cent the first month. Only about 25 per cent of the deaths occur the second month, and for older calves the mortality is usually less than two per cent. Thus, about 80 per cent of the calf losses occur the first 60 days of age. Scours and pneumonia account for the majority of deaths. The germs which cause infections or white scours are harbored in barns, bedding, floors, etc., and are very hard to eliminate. The virulency of such germs is often very high and it is not uncommon to find 75 to 90 per cent of the affected calves dying or seriously retarded in growth. A sanitation and management program which has given good results in curbing these losses is as follows:

Provide a clean, disinfected maternity pen with clean fresh bedding for each cow at calving time. A 13 ounce can of lye dissolved in two gallons of water makes a good disinfectant for concrete floors and should be applied after the floor is scrubbed clean and before the bedding is put in place.

As soon as the calf is born paint its navel cord with tincture of iodine. This is a precaution against body infection.

Before the calf nurses the first time, wash the cows udder with warm water and soap and then rinse the udder off with clean warm water containing 250 parts of available chlorine per million. (Directions for making chlorine to strength are given on the container). Wipe the udder dry with a clean cloth.

Be sure the calf gets a good feed of colostrum or "first milk." Colostrum contains anti-bodies which give the calf resistance against disease, is rich in vitamin A or carotene, and has a beneficial effcet on the bowels.

Leave the calf with the cow two or three days, or keep the calf in a separate pen and permit it to nurse three times a day for the first three days. Wash and disinfect the udder and teats each time before the calf nurses.

Don't overfeed. About one pound of milk for each 10 to 12 pounds of body weight per day is sufficient. An 80-pound calf should get about one gallon of milk (divided into three feedings) per day. Be sure the milk is warm, 95–98 degrees Fahrenheit, at feeding time. Overfeeding usually causes common scours.

Keep feeding pails clean. Give them same care and treatment as milk pails for Grade A production. Nipple pails are very satisfactory and may prevent the calf gulping the milk and reduce digestive troubles.

Keep the calf in a draft-free, dry, well-bedded pen. The use of slatted floors underneath the bedding will help insure dry pens.

Don's overcrowd the calf quarters. Small individual pens are best and likewise small colony houses, which hold only six to 10 calves.

At the first signs of scours or sickness, remove the ailing calf to separate quarters and preferably clean up and disinfect the pens and put in clean bedding for the remainder of the calves. The use of sulfa drugs, penicillin and streptomycin have demonstrated their value in treating calf diseases—but prevention is the best cure.

4. Select a Feeding Program That Fits Milk Supply

One of the most common mistakes made in calf raising is the belief that there is a satisfactory substitute for whole milk the first few days after a calf is born. Calves have been kept alive, but few cases of thrifty, normal growth are reported where milk is not supplied the first few weeks of life.

Where whole milk is sold, calves may be raised successfully by feeding whole milk for a short time and gradually switching the calf to a dry grain mixture or calf starter. Much labor is saved by feeding the dry mixture, and the necessity of having hot water at feeding time is dispensed with. There are no pails to wash after the first six weeks to two months, and the danger of spreading digestive troubles is lessened. Under the plan the calf is fed whole milk for six to seven weeks. From the first week on the calf is induced to eat just as much concentrate mixture and leafy green hay as

Calf Starter Formula

Feeding Stuffs	Pounds	Protein (Crude)	Digestible Protein	Total Digestible Nutrients
Ground yellow corn (No. 2)	300	28.20	21.3	241.80
Ground Oats	300	36.00	28.2	214.5
Wheat bran	100	15.80	13.1	70.2
Linseed meal (34 per cent)	100	35.30	30.7	78.4
Ground alfalfa (very leafy green)	50	8.25	6.2	26.85
Soybean meal (41 per cent)	50	20.45	27.4	40.25
Dried feeding skim milk	50	17.40	16.55	42.05
Soluble blood flour	27.5	24.39	23.43	24.06
Steamed bone meal	10.0			
Salt	10.0			
Reinforced cod liver oil	2.5			
Total	1000.0	185.79	156.88	738.11
Average		18.6%	15.7%	73.8%

possible, and the amount of whole milk is cut down gradually. A dry grain concentrate, containing skim milk powder and other feeding stuffs, generally readily obtainable by the dairyman at his local feed store, is suggested in the Calf Starter Formula given below.

There are good commercial "calf starter rations" on the market, and they can often be bought as cheaply and conveniently as home-mixed if only a few calves are to be fed.

Calf gruels are generally not satisfactory as the dry starter. If they are used they should be fed according to the manufacturer's directions.

Use of skim milk — where cream is sold. Skim Milk, when supplemented with a grain ration and plenty of good roughage, is the best feed for the calf up to six months of age. The change from whole milk to skim milk should usually be started when the calf is between two and three weeks old, depending upon the development and health of the individual.

The change from whole milk to skim milk should be gradual. One pound of skim milk may replace an equal amount of whole milk, the substitution being made at the rate of about one pound per day. As a rule, the calf will be entirely on the skim milk ration by the time it is about one month of age. Thereafter the amount of skim milk should be increased gradually until the calf is receiving about 10 to 14 pounds at two months of age; 12 to 16 pounds at three months of age; and most calves will take 16 pounds before they reach the age of four months, after which time the amount of milk should not be increased. A good quality, leafy, green hay (preferably legume or mixed hay) should be kept before the calf at all times. Silage is too bulky and high in fiber for calves and is not recommended until they are at least three months of age.

The calf begins to eat a little grain at 10 days to two weeks of age. During the second month the grain consumption will average one-half to one pound. The grain mix for the growing calf may be made up of homegrown grains supplemented with linseed or cotton seed meal. A typical grain mixture, utilizing feed stuffs usually readily available consists of:

	Lbs.
Ground yellow corn	500
Ground oats	250
Wheat bran	200
Linseed oil meal or soybean oil meal	50
Salt	10

The Use of Nurse Cows. Some dairymen, particularly those engaged in the raising of high class pure breds, prefer to use nurse cows to furnish whole milk during the first few weeks of the calf's life, which generally results in sleeker, healthier calves. Troubles with scours, often caused by the calf gulping milk too fast, "pot-bellied" calves, and contaminated feed pails are eliminated with this plan.

One nurse cow can handle two to four calves at a time. Each calf should get eight to 10 pounds of milk per day, and until they are 50 to 60 days of age they should be allowed to suckle two or three times daily. After the calf is two months old it should be with the nurse cow only once a day until weaned. By the time the calf is two weeks old it should have access to hay and a dry grain mixture similar to the following:

	Lbs.
Yellow corn meal	20
Ground or rolled oats	20
Wheat bran	20
Linseed oil meal	20
Skim Milk powder	20

Salt, or a mixture of equal parts of salt and steamed bone meal should be kept before the calves at all times. Fresh water should also be provided after the calf is a few weeks old.

Calf meals — gruels — reconstituted milk. Where powdered skim milk or whole milk is not prohibitive in price, it may, satisfactorily, replace liquid milk by adding one pound of milk powder to 10 pounds of warm water. The result is 11 pounds of skim milk or whole milk of usual composition and feeding value. Reconstructed milk is fed exactly the same way as ordinary milk. Care should be taken to see that remade milk is at body temperature (95 to 100 degrees Fahrenheit) when fed. Grain and roughages are fed according to suggestions given for limited whole milk and skim milk feeding plans.

Calf meals, or gruels, are often used to reduce the amount of milk required for calf raising. Where this plan is used the whole milk feeding period should be at least four weeks. The calf meal is then gradually substituted for whole milk so that the calf is entirely on the calf meal ration by the time it is six weeks of age. There are a number of commer-

cial mixed calf meals available on the market, or the dairyman may mix his own. A calf meal which has given very satisfactory results consists of 100 pounds corn meal or hominy; 30 pounds linseed meal; 30 pounds rolled oats; 20 pounds dried blood flour; 20 pounds skim milk powder and one pound of salt.

The usual plan of feeding these calf meals is to mix them with warm water in the proportion of one pound of the dry calf meal mixture to six to eight pounds of water. The gruel thus prepared is fed approximately the same quantities as skim milk and with the same supplementary hay and grain feeds. The tendency in recent years has been to get away from the liquid calf meal, which eliminates the difficulty of having warm water and pails to clean and sterilize. The limited whole milk plan, where a dry fed "calf starter" is used, simplifiies the feeding procedure.

Feeding and Management of Young Dairy Stock

Heifers over six months of age are comparitively easy to care for but should not be neglected. At this age the heifer is growing rapidly and responds to good care and management by very economical gains in body size during this period. Studies at the Missouri Agricultural Experiment Station show very clearly that neglecting the feeding of calves between six and 12 months of age results in an increased growing cost. Heifers should not be kept fat, but rather growing rapidly so as to be sufficiently developed to be bred for freshening at the normal age for the breed.

From six months to one year of age the heifer may be fed mostly on roughages, including pasture, with a moderate amount of grain. During the summer months green pastures furnish excellent and well-balanced feed for growth. Unless the pasture is unusually good, however, a little grain feed is recommended, and this is most important for extremely young calves, six to nine months of age. Early in the spring, during hot, dry weather, and during the fall months when pastures are short, hay and silage in addition to grain should also be provided. Heifers from six to 12 months of age will eat from five to 10 pounds of hay daily and from five to 15 pounds of silage, the silage replacing some of the hay. Legume hays, such as alfalfa, clover, soybean and cowpea, or a mixture of these hays and nonlegumes, is excellent for growing heifers. This form of roughage is rich in minerals and vitamins necessary for growth. Roughages may very satisfactorily be fed free choice and just enough grain supplied to keep the heifers growing well. Where plenty of legume rough-

ages and silage are available, a grain mix consisting mostly of corn and oats is desirable. Suggested mixtures are:

	Lbs.
Ground corn	300
Ground oats	200
Wheat bran	100
Ground corn	400
Ground oats	200
Wheat bran	100
Linseed oil meal	100

Where only non-legume roughages, such as corn stover, timothy hay, straw, etc., are available, a grain mixture containing 15 to 16 per cent protein should be fed.

In a series of experiments with Holstein and Jersey heifers, workers at the Missouri Station found that the average age Holstein heifer grown at a normal rate from six to 24 months of age, on a maximum roughage and pasture utilization program, consumed 854 pounds of grain concentrates, 2,389 pounds of legume hay, 3,016 pounds of silage and was on good pasture 288 days. One group of heifers did not receive silage and required 1,232 pounds of grain, 4,818 pounds of legume hay and were on pasture an average of 263 days.

Jersey heifers between six and 24 months of age, to make normal growth consumed an average of 879 pounds of grain, 3,385 pounds of hay, 1,820 pounds of silage and were on pasture 284 days.

Normal skeletal growth, as measured by height at the withers and chest circumference, was secured where approximately 55 per cent of the total protein and digestible nutrients were secured from pasture. It was clearly demonstrated that calves well-fed to six months of age can be reared from six months to two years of age with an average grain requirement of not over 900 pounds where plenty of good roughage and pasture is available.

A summary of the feed requirements for growing heifers in these trials indicates that about 10 per cent of the energy and protein came from grain concentrates, 35 per cent from hay and silage, and 55 per cent from pastures.

The heifers were housed in a shed type of barn, open on the south side, but closed on three sides. Hay and silage were fed in large feed bunks. One man cared for some 80 head of heifers and dry cows under this system, in addition to much additional farm work.

The amount of grain fed and the period of time that grain was fed were variable depending on the amount and quality of roughage fed and the apparent condition of the heifers. The general plan of the grain feeding was to supplement roughages so as to keep the heifers in good growing condition.

The use of such a program means economical growth, strong and hardy heifers, good soil conservation practices, cheap housing and efficient use of labor.

Farming In Alaska

Condensed from Foreign Agriculture

J. H. Christ

On a 1914 soil reconnaissance of the Cook Inlet-Susitna region of Alaska, Hugh H. Bennett found a million and a quarter acres of bench and plain-like country "quite favorable to farming."

"About one-half of this good land occurs in the Susitna and Matanuska Valleys," Bennett and Thomas D. Rice, his fellow soil surveyor, wrote in their report of their summer's rugged work.

"The good agricultural lands—the benches, hillocks and ridges —are largely occupied by the Knit soils, which have well-established drainage," the men wrote.

In making the reconnaissance of some 40 million acres in the 1914 and 1916 summers Bennett's parties used pack horses, rowboats, power boats, automobiles, river steamers, and the Copper River and Northwestern and the White Pass and Yukon Railroads.

Agricultural development of Alaska has centered in the area which Bennett and Rice delineated, particularly in the Matanuska Valley, which has had widespread mention.

Bennett then held the title of inspector in the old Bureau of Soils. Bennett today, 36 years later, is chief of the Soil Conservation Service, which is following up his 1914 and 1916 work in Alaska with more refined soil conservation surveys of promising portions of the Territory.

The Soil Conservation Service now has detailed conservation survey information on approximately 1 million acres of land in Alaska. Of this, 200,000 acres are represented in areas of the Public Domain withdrawn from settlement by order of the President of the United States until their value for agricultural use can be determined.

It was on Bennett's findings that subsequent detailed studies under the leadership of William A. Rockie were started in 1939. Rockie's conservation surveys provided inventory for the land surrounding Palmer, Matanuska, and Wasilla. The war years intervened, and work was resumed at Dunbar in the Tanana River Basin and at Kenai on the Kenai Peninsula in 1948. The year following, 1949, other potentially important areas were studied on the Kenai Peninsula, and surveys

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were completed at Kenai-Kasilof, Ninilchik, and Homer-Fritz Creek, the Department of Interior having withdrawn these lands from settlement for such a survey. The past season, 1950, has still further increased the coverage of detailed land information at Fairbanks, Homer, Anchorage, Chugiak and preliminary material at Salcha-Big Delta.

Although a farming of sorts has been going on in Alaska for more than a century, it was not until 1935 that there was a major influx of settlers. This was the Matanuska Colony undertaken through the medium of the Alaska Rural Rehabilitation Corporation. Started as a relief measure during the depression years of the thirties, the produce of these farms and others in the Territory provided materially to the armed forces stationed in Alaska in World War II. It showed conclusively, too, that there was an agricultural future for this great land, and that sound agricultural settlement was needed to provide local products to the key military establishments that provide a protective facet for the North American mainland.

There is no doubt that many believe strongly in Alaska's agricultural future. Following the war many veterans exercised their GI privileges in taking up homesteads in locations of their choice. Even at this date filings for land are recorded at a rate of 60 to 70 a month during the months that the lands can be examined.

It is to help these settlers that accurate information is being secured. Critics have often declaimed the policy of our Government in permitting settlement of land poorly suited to farming. However, without facts pointing up the character of the land and its potentialities and its limitations, little else could have been expected. But now on this new frontier we do have the facts, and they are available to settlers wishing to have a reliable guide for their investment and effort.

The Alaska Soil Conservation District law, enacted in 1947, declared the entire Territary of 586,000 square miles a soil conservation district. In the Subdistricts formed at Palmer, Wasilla, Chugiak, Anchorage, Homer, Fairbanks, and Salcha-Big Delta, land-capability information is now available at the offices of these units of Territorial Government.

There is good land in Alaska. The proof of this is shown on the farms in many localities. Yields are good and quality is high. But not all the favorable-appearing land is good, nor can it be farmed indifferently. Wind and water erosion can be just as damaging in Alaska as it is on State-side lands.

Deteriorating yields through reduction of fertility can come about even more rapidly because

Alaska's lands are not inherently high in fertility. Of the area mapped, about 20 per cent falls in Classes II and III, those primarily adapted to cultivated crops; 20 per cent in Class IV, which has best use in meadow and pasture; and the balance in Classes V, VI, and VII, which may be used for range or timber production; or Class VIII, which because of steepness, rocky character, or climate, has no agricultural value.

An observer from outside will quickly note the shallow silt profile that overlies the gravels of the Kenai Peninsula, the Matanuska and Susitna Valleys, and the Delta Valley of the middle Tanana region. Again, he will marvel at the depth of the silt deposits in the Fairbanks section. And, interspersed with these, he will note the extensive areas of muskeg. The boggy, poorly drained areas are present in all localities.

Even on the best lands it's no bed of roses. As a GI homesteader put it to me, "This easy-money idea is a laugh—making anything out of a homestead is the hardest money I ever earned." Then he added, "But we like it. We're running our own outfit. It's a good place to live and a good place to bring up kids."

Another thing to learn is that farm crops are limited to a narrow elevational range and that they are greatly affected by the direction of slope. Rather arbitrarily, the uppermost limit is in the vicinity of the 1,000-foot contour. Favorable air currents raise it in some sections, lower it in others. Then, too, it drops off as one goes farther north. The sun's rays hit these lands at a low angle. For that reason north slopes are extremely slow to warm up, and frozen ground can be found almost on the surface throughout the summer in the interior.

Root crops and leafy vegetables give excellent yields under good management. The bounty of these crops leads the settler to rely on them for his early cash income. It's about the only move that can be made on the small acreage initially cleared to put hard money in the pockets of the settler. But it's highly competitive, for just as the newcomer sees an early return from his land in these crops so also does the farmer who has a greater acreage of cleared land, and who also has learned how to grade and package his produce, and has established a firm market outlet for his crops. There is a limit to the consumption of cabbage, rutabagas, beets, potatoes, lettuce, chard, and the like.

The farsighted farmers are taking a realistic attitude toward their future. They see the ease with which the cash-crop market can be broken, and they see the same erosion pattern starting that earmarks much of the one-crop

farming in the States. Naturally, their ideas shape up in a permanent cropping system that includes livestock as its core. There are winter hardy grasses and legumes adapted to Alaskan conditions. There are severe years when there are heavy winter losses, but the same conditions prevail at times in our northern tier of States. We likewise find winter losses the heaviest when the stands are weakened by heavy grazing or run down by poor fertility-maintenance practices. So, good management is just as essential to good farming in this Land of the Midnight Sun as it is elsewhere.

The settler needs to learn how to take care of forage under the conditions of summer rainfall. Maybe he will be willing to sacrifice somewhat on yield to gather in an early crop when the good weather prevails, or he may have a silo and silage-producing equipment so that the feed reserve can be preserved in the more inclement weather. Or he may field-cure his hay by the more laborious process of shocking it on standards, a sight frequently pictured in rural Scandinavian scenes. Strangely, hay so stacked continues to cure and provides a feed high in quality.

Over the years, the plant breeders of Alaska and of foreign countries in the same latitude have developed varieties of barley, wheat, and oats that give pretty reliable returns, thus cutting down on an expensive feed bill for the shipped-in concentrates. Varieties suited to the use of a combine have yet to be isolated, so the binder and field shocking are standard practice. The crop at times may be threshed from the field, or it may be stacked and threshed after the weather settles into the colder months.

With farming shaped up about a livestock economy, certain benefits are apparent. An easily flooded vegetable market is avoided, and the elements of good land husbandry are on top. The same processes that formed these soils are ever present to tear them down. Winds of high velocity whip up the glacial flour from the annual deposits along the bars of the streams. None of the land so built has a great enough depth to warrant having it exposed by ill-considered farming methods. A good winter cover is essential, and a rotation that includes long-lived grasses and legumes builds up the organic matter, and with it the fertility. Wind-breaks of native timber, spaced at appropriate intervals, both as the farm is being developed and later to furnish protection to the intervening cultivated strips and a future fuel and lumber supply, seem to have an important place in the farming scheme.

On the sloping lands and

deeper soils laid down as water or loessial deposits the water-erosion hazards are high. These immature soils have high erosion tendencies. They cut quickly and deeply as runoff water concentrates on them. Here contour farming can be used effectively, and experience may show that terracing or diversion channels, coupled with crop rotations, have an important place. Sheet erosion is present, too, and rain on the thawing soil in the spring can flush a layer of the most productive soil from the slopes and redeposit it on the bottom lands.

The prospective settler today may well think over the 1914 suggestion of Bennett and Rice. "Before going to Alaska it would be strongly advisable for the prospective immigrant to make a careful study of the geography of the region, its climate, soils, crops, transportation facilities, market conditions, and population; and sufficient capital should be available to carry the new farmer through a period of one or more years during which he will be busy clearing land and constructing necessary buildings."

So, wherever you go you find that good judgment needs to be the companion of good farming. There's no more reason for laxity in developing a farm in Alaska than there is in the States. There are people there who realize this, and their counsel can be used to excellent advantage by the farmer who is caught irresistibly by the wonders and drawing power of the Northland.

When Tile Is Not Enough—Use A Pump

Condensed from Electricity On The Farm

Virgil Marvin

FARMERS have always drained wet spots in meadows by means of ditches or tiles. In the past this practice has been limited for economic reasons to those fields from which gravity flow was obtainable. Now that farmers have electricity available, the use of pumps has made it possible to drain practically any field. Conventional tiling systems are used which drain into a large sump or ditch in the field to be drained. From this point, the pump raises the water to another ditch with sufficient elevation to allow the water to drain away from the area. Usually only a small lift is involved. Frequently the tile outlet is less than two feet below the ditch level. It is seldom more than six feet.

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New York City, New York, February 1951

Typical of this new development is the drainage system installed in a 25 acre field on the farm of Ira Jones, Fulton County, Ohio. Having a perpetually wet spot of 5 acres, near the center, the field had very little value to the owner. Water stood in the depression a great deal of the time and the area was being taken over by willows and cattails. Jones laughingly recalls that he once seriously considered going into the frog farming business in order to get some use of the tract. He forsook the idea as being too risky, however, and he resolved to drain the land if it were at all practicable to do so.

Experience was borrowed from persons farming low land near Lake Erie. There, much of the land is diked and pumped. It is similar to the well-known windmill powered projects in Holland.

Tile drains were laid in the conventional manner in Jones' field with the outlet brought to the concrete sump. The cost of the sump was about $200. The tile outlet was 2.1 feet lower than the ditch into which the water was to be discharged. This was the point where the pumping system was installed. Since the volume of water that could be contained within the sump was relatively small, two obstacles had to be overcome. First, the electric motor had to be located above the highest possible water level. This would prevent submersion in the event the flow into the sump exceeded the capacity of the pump. Second, a float control was needed to make the outfit completely automatic.

Both of these conditions were satisfactorily met by installing a centrifugal pump. It was the cellar-drainer type except that it was considerably larger. The 2 hp electric motor was well above pump water level. The 200 gal. per min. unit has proven adequate even for spring flood conditions. The cost of the pump and wiring was about $300.

Mr. Jones figured that this installation should be charged off over a period of about seven years. On this basis, the cost per year per acre for drainage amounted to $7.15 per acre. This figure includes the cost of energy to operate the pump.

The pump used on this job was adapted for the small area involved. On larger fields the type of pump most generally used is the propeller type of centrifugal pump. It is simple, rugged, serviceable, and has a high rate of discharge at low lifts. Its power requirements are relatively constant. The maximum lift usually does not exceed 6 feet. Most of the water will be lifted no more than 3 or 4 feet. The capacity of this type of pump is usually based upon a fast flow at the discharge opening. Therefore, the intake pipe and discharge pipe

should be as short as possible. This will keep the friction head at a low figure.

Typical of this type of installation is the farm of Pete Wilhelm of Lucas County, Ohio. Mr. Wilhelm has drained 155 acres of tiled land that was once a swamp bordering Lake Erie. Water was pumped from a drainage ditch by a 7½ hp–12 inch pump. This pump is capable of pumping 2600 gallons per minute. Mr. Wilhelm's initial investment amounted to $869. Charging this off over a period of seven years, Mr. Wilhelm's cost per year per acre including operating costs amounts to one dollar.

It is evident from the above figures that some pretty fine farm land can be reclaimed very reasonably. Seven other farms in this area were studied. The following figures are averages for these seven farms. They will give you an idea of the factors involved in this type of operation.

Average acres drained per farm	85
Average pump size	8¾"
Average maximum lift	7'
Average tile spacing	56'
Average horse power requirement	5.6
Average total cost (Pump, motor, pumphouse)	$591.50
Average kilowatt-hours per month per acre	2.66
Average cost per year per acre (investment charged off in seven years—includes cost of electricity)	$ 2.00

Costs of tiling or ditching are not included in the above figures.

In planning an installation of this type there are several points to keep in mind. The type of pump referred to handles large volumes of water, but the lift required should be held to the lowest possible amount. The delivery of an 8 inch pump operated at 1375 rpm by a 5 hp motor will drop from 1800 gallons per minute at a head of 3¼ feet to 660 gallons per minute at a head of 4¼ feet.

A relatively large reservoir should be provided to feed the pump. A float control system adds convenience to the job. The water is removed as it accumulates without attention. The reservoir should be large enough so that not more than four motor starts per hour will be made. A typical installation for a 5 hp motor operating a 6 or 8 inch pump would be a ditch 15 feet wide, 7 feet deep, and from 200 to 300 feet long.

During times of heavy flow, a layout of this nature can be manually controlled without an undue amount of attention. It may be left running for extended periods if necessary.

Have you been wanting to buy another piece of land so that you could increase your operation? If you have, and you need it, go ahead. But first check the low spots on your own farm. You may be able to buy it from yourself.

Cultivation Essential For Crop Growth

Condensed from Report of Progress

Connecticut Agricultural Experiment Station

THE increasing dependence upon chemicals for controlling weeds in agricultural crops has tended to mean less use of the cultivator for this purpose, but experiments at The Connecticut Agricultural Experiment Station during the past three years show that the cultivator is not ready for retirement. Results show that, aside from its merits in destroying weeds, cultivation definitely steps up crop production.

According to Dr. C. L. W. Swanson and H. G. M. Jacobson of the Station's Soils Department, soil on cultivated plots showed improved structure and better aeration than that on plots treated with the chemical weed killer, 2,4-D. The better aerated soil released more nitrogen to the plants which produced a larger yield.

The test crop used was corn. On one-half the plots, 2,4-D was used exclusively for weed control. On the other half, cultivation was relied on to take care of the weed problem.

Results were particularly striking during the 1948 and 1949 seasons, both hot, dry summers, interspersed with infrequent, but heavy downpours of rain. On the 2,4-D plots, undisturbed by the cultivator, a hard crust formed, while the soil on the cultivated plots was porous and in good condition. More striking than the variation in soil, however, was the contrast in the crop grown. The corn on the 2,4-D plots was smaller and lighter green in color. At the end of the 1948 season, the cultivated plots yielded 61.5 bushels of corn per acre, while the plots treated with 2,4-D produced only 15.2 bushels. Corresponding figures for 1949, when weather conditions were somewhat more favorable, were 94.6 and 68.3.

Yield differences were much less pronounced in 1950, which was an ideal year for corn production. All plots did well, with the area treated with 2,4-D producing only 15 bushels less per acre than the cultivated plots. However, measurements of nitrogen in the harvested corn grain showed that the cultivated corn contained substantially more nitrogen than that receiving 2,4-D treatments. It is known that protein content increases directly as nitrogen content increases, so the

Reprinted from Report of Progress,
Connecticut Agricultural Experiment Station, New Haven,
February 21, 1951

the food value of the cultivated corn was greater.

While the experiments were not designed to compare the efficiency of the two methods in controlling weeds, but only their effect on crop growth and soil tilth, observations did show that weed mortality on the 2,4-D plots was lower.

Despite the favorable results with cultivation, however, there is some evidence that it can be overdone. Soil examination of the corn plots under continuous cultivation for three years showed, that in areas where the tractor wheels had traveled many times, structure was poorer than in the spots where the wheel did not strike. Plans are to continue these experiments for several more years to see just how deleterious this compacting effect is on the soil and on crop growth.

From the past three years' work, it would appear that in hot years with rains which are very heavy when they do occur, cultivation is essential. In years when weather conditions are more favorable for crop growth, some cultivation will give better results than reliance upon chemical weed-killers alone. Probably the answer will be a judicious use of both methods of weed control, with the proportion dependent upon growing conditions.

Rainfall From Reluctant Clouds

Condensed from The American Hereford Journal

Brownlow Wilson

A CALAMITOUS drouth appeared to be imminent in northwestern New Mexico in the spring of 1950. It looked as if the whole district was entering a major drouth cycle.

In the Cimarron district, less than half an inch of moisture had been recorded in the previous six months. There was absolutely no early grass because there was a complete lack of moisture at the grass roots. Cattle were in extremely poor condition. A great many ranchers shipped their cattle out to leased pastures, which always results in a heavy financial burden. But there appeared to be nothing else to do for there was no hay left to feed.

Realizing the seriousness of the situation, Albert K. Mitchell, Albert, N. M., Hereford breeder, contacted Dr. Irving Krick, head of the Water Resources Development Corporation, Pasadena, Calif., which corporation undertook to make a survey with a

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view to ascertaining whether by cloud seeding operations increasing precipitation could be produced. The survey led to a favorable conclusion. The engagement of their services involved the outlay of a considerable sum of money which Albert Mitchell personally guaranteed.

As a result of this survey, the WRDC came to the conclusion that its representatives could undoubtedly increase the normal precipitation during the months of July, August and September, when, they forecast, some 11 opportunities would probably eventuate. But better results could have obtained they thought, had they been able to start operations earlier.

Dr. Krick, who spent many years as a meteorologist, stated quite frankly that they should not be called "rainmakers," which title had been bestowed upon them by newspapers and periodicals, but rather "rain-increasers," because, he explained, they could not make it rain unless it would have rained anyway. However, he was confident they could increase the actual precipitation from any given storm, and, in addition, make it cover considerably more ground.

Roughly, the target area consisted of a square some 125 miles long and 125 miles wide, taking in all the country between Raton and Cimarron, and on down through Roy and Mosquero to Tucumcari. The seeding agent used was silver-iodide smoke, chosen because silver-iodide particles have approximately the same crystal form as ice particles. The smoke was released from Jeep-borne generators, which sent up untold trillions of particles each minute. The clouds were seeded during the first few days of July, and on July 3 a good rain fell all over the target area. The critical situation was alleviated.

The resulting precipitation throughout the target area showed an increase of from 150 per cent to 400 per cent over that recorded in the surrounding districts. In the best part of the concentration, eight inches of rain fell during July alone, constituting a new all-time record. And this occurred in a drouth year. Throughout July and August, between 11 and 12 inches of rain fell on the target area, and by the end of August there was the best stand of grama grass in living memory. It would have been possible to cut hay on the prairies almost anywhere.

Albert Mitchell stated that whereas the area's summer rains usually include quite a few cloudbursts, of which approximately half runs off, making gullies and washing away top soil, all of the rain last summer fell in the form of slow, steady rain, most of which went right into the ground. Thus the increase in precipitation rep-

resented much more, percentage-wise, over what the figures showed for other years. At Albuquerque, some 100 miles to the west, the total recorded precipitation for the year amounted to only 4.1 inches.

The services of the WRDC were also engaged last year by various banks to increase the rainfall in southeastern Colorado, which was also experiencing a devastating drouth. A somewhat later start was made in this area, and thus several good seeding opportunities were lost; nevertheless, some eight inches of rain fell over a large part of that area during July and August, the crops were saved and the grass growth responded excellently. The results were so encouraging that the ranchers and farmers of that area engaged the services of the corporation again last fall, on a year-round basis, to increase the snow pack at the headwaters of the Arkansas River, from which their irrigating water originates, and for increasing the precipitation over their land during the spring and summer of 1951.

Many interested persons ask how much it costs. The actual cost in New Mexico for three months of operation amounted to one cent per acre for those who participated, and their gain must have been ten times their expenditure.

After the rains had come, Ed Springer of the CS Land & Cattle Co., at Cimarron, sent out a circular letter to all the ranchers in that district, stating simply what Albert Mitchell had done and suggesting, if they thought they had benefited from the precipitation which had resulted from Albert's expenditure, perhaps they would like to contribute say one cent per acre on their lands to reimburse Albert Mitchell for the money he had put out from his own pocket. The result of this canvass resulted in more money coming in than had been expended. Albert Mitchell left in a large amount of the sum he had already put up, and the remainder of the money raised was kept in a fund to pay for cloud seeding operations this year.

Dr. Krick believes about a third of a cent per acre per month would about cover their services, provided most of the land owners signed up. Thus if the operations were carried out on a year-round basis, as would be prudent, the cost would be four cents per acre.

Briefly, the rain we get in Colorado and New Mexico in the summer usually results from the following meteorological conditions: Constantly warm, moist air is being sucked in from the Gulf of Mexico, and when it reaches the mountains it rises, because it must. Periodically during the spring and summer months, cool, dry air

masses, originating over the Pacific Ocean proceed eastward over the United States, and when one of these air masses reaches the Continental Divide it collides with the moist, warm air from the Gulf. The moisture in the warmer air mass is then condensed into clouds which are carried in a generally easterly direction over Colorado and New Mexico by the air mass movement, and some precipitation should result.

Such situations can be expected to exist perhaps some four to eight times during the month of July, from three to six times during September. The actual number of opportunities depends on whether it is a wet or dry year, there being fewer opportunities in dry years.

Of course, sometimes this collision takes place beyond the divide, which produces rain on the western slope states.

Somewhere in the sky above us is a frost line, above which, if there is any moisture in the air, ice particles will form. Since the moisture in the clouds is supercooled, the moisture does not form into ice particles until the temperature drops to zero degrees Fahrenheit.

When it does, the moisture in the clouds above the frost line will gather into small ice particles, provided—and this is the crux of the matter—it can find enough dust or other particles to nucleate around. Once the ice crystals grow into snowflake size they gradually become too heavy to be suspended in the cloud, so they will drop toward the ground.

If the temperature down to the ground is below freezing, the resulting precipitation comes down in the form of snow. If it is above freezing, the snow-flakes melt and fall as rain.

Very often, in nature, only the top one-third of a cloud will be super-cooled enough so that moisture below the zero line is carried away overhead without coming down at all. Therefore, when we encounter the tantalizing experience of seeing clouds passing aimlessly overhead with no precipitation materializing, it simply means that none of the cloud is above the zero line. Actually, if nature brings down 30 per cent of the potential precipitation from any given cloud, it is doing fairly well.

Silver iodide particles have one tremendous advantage over ordinary dust particles in that when nucleating around them ice particles will form at 25 degrees Fahrenheit instead of at zero F. This means that all the moisture in the cloud above the 25-degree line, which is much lower than the zero line, can nucleate into ice crystals, and later snowflakes, and will fall as snow in winter or rain in summer. Very often the increase in resulting precipitation will amount to from 100 per cent

to 500 per cent from any given cloud, depending on how much of that cloud lies between the zero and the 25-degree line.

Silver iodide was selected as an ideal agent for increased nucleation because its crystalline form approximates very closely that of ice particles. When silver iodide smoke is released from ground generators, a sort of smoke plume is formed which widens out as it moves from the projector and rises into the air. Usually it is released to be carried upward and toward the mountains—in Colorado and New Mexico operations—by the warm air coming in from the Gulf of Mexico.

When it reaches the mountains, it rises, because it must, to be carried up the mountain slopes until it collides with the cool, dry air mass coming in from the Pacific. Each of its particles is a potential gathering place around which an ice particle, and later a snowflake, can form.

In addition, a sort of chain reaction is set up within the cloud, as the trillions of ice particles cool other droplets into ice, until the actual size of the cloud is increased so that it will cover a far greater area of the sky. Then, as it drifts with the wind, rain or snow will fall over much more ground than would have occurred had the clouds not been seeded. Precipitation will be recorded over a much larger base and much further downwind than would otherwise have resulted.

The WRDC meteorologists know in advance when these seeding opportunities will occur, because they know when the cool air mass from the Pacific will collide with the warm air from the Gulf. The Pasadena office keeps in touch with ground generator operators in the field by long distance telephone, and operators are instructed to release their smoke from carefully selected locations, calculated so that rain will be increased over the target areas. Therefore, it can easily be seen that if anyone tried to seed the clouds with his own generators he would probably have to seed them every day of the month in order to insure catching the correct opportunities. Even then, unless he was a trained meteorologist, he would hardly be able to release his smoke in the right locations in order to cause precipitation to fall upon his own land. Actually, as often as not, no clouds can be seen when the generators are turned on, and the field men pay no attention whatsoever to cloud formations. They simply turn them on when the Pasadena office tells them to do so, and at locations worked out by the head field man, when the office calculates the two air masses will collide. It is not until they do collide that clouds will be formed.

Cloud seeding cannot take any

appreciable amount of rain from other districts. The most it could conceivably take, Dr. Krick thinks, would be 1 per cent from any given storm. But it would be much more likely to increase the rainfall over a much larger area than covered by the target area, although this increase would probably not be nearly so great as within that area.

His corporation has been in operation since 1947, and there has never yet been a lawsuit filed against it by any district or individuals who thought the said corporation had taken rain away from them, or given them too much rain. If any prospective customer fears such suits, Lloyd's of London will insure them against it if the WRDC services are involved.

Actually, a study of the northeastern New Mexico and southeastern Colorado operations revealed that the whole country to the eastward of the seeding operations benefited by receiving more precipitation, and these benefits extended clear through Kansas, Oklahoma and Texas to the Gulf.

The operators found many more seeding opportunities than they had expected would exist, simply because when the skies were well seeded with the particles, clouds formed when otherwise none would have existed. Sometimes these were seeded for their own sake instead of waiting for the air-mass collision to take place. He also says that it is possible to over-seed a cloud to such an extent that so many ice crystals will be formed that no moisture will be left to form snow flakes around them. Therefore no snow or rain will fall. So inexpert seeding could take rain away instead of increasing it.

Albert Mitchell told me he thought an annual program of cloud seeding in New Mexico could result in the ranchers being able to run one cow to 20 acres of land instead of one to 30, as is generally required today. If this came about, it would mean that each ranch could carry 50 per cent more cattle without overgrazing at all. Fifty per cent more beef thus could be produced from each acre of these ranches.

Perhaps the day will come when the prairie states will conduct cloud seeding operations on a statewide basis. If they ever do, it is easy to see how their tax revenue would be increased from the greater cattle population, the ranchers would make more money, and they would plow more back into the economy.

Everyone in the participating states would benefit indirectly. Dry years could be made better than normal ones, and normal ones into bumper ones. Districts which can only raise a good wheat crop one in seven years, as was the

case in some parts of northeastern New Mexico, could raise a good crop practically every year.

The possibilities are almost unlimited. The only governing factor I can foresee is how much precipitation the prairies could stand without drowning out the grama grass, which grows very well with up to 20 inches of moisture a year, but which might die out if we got 30 inches.

So it can be seen that it is important to gauge the amount of seeding needed to produce the maximum possible growth from existing grasses, without getting so much rain they would be drowned out. It would seem that the solution is that the program should be carried out on a year-round basis, so that the precipitation would be spread out through the growing months, with most in the spring and early summer and less in the fall, when our grasses normally cure up without rain.

Incidentally, last year's operations demonstrated that rains will continue up to a month after the seeding operations are shut down, because the air becomes supercharged with silver iodide particles, and it takes that long before they are all used up in inducing rainfall.

The calls upon the services of Dr. Krick's organization have been so great from the prairie states that he has leased a building in Denver and proposes to move his headquarters there for the future.

Pregnancy Disease In Ewes

Condensed from The Dakota Farmer

Dr. J. W. Bailey

DURING LAMBING season many sheepmen are concerned about the possibility of pregnancy disease affecting some of their ewes, for this trouble is becoming recognized as one of the commonest and most costly of sheep diseases. In various localities, it has been reported as causing losses ranging all the way from one to 25%.

The earliest symptoms are apt to consist of staggering, stumbling, or an uncertain gait. Extreme nervousness, twitching of ears, and jerking of different body muscles may also appear as early symptoms. In large flocks ewes may shun the others and try to get away somewhere by themselves. Sicker ewes may walk around and around in endless circles. Others may stand motionless for hours on end, with a few

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forgotten spears of hay clenched in their teeth, or with their noses pressed hard against something like a post or the side of a building. At other times they appear dull and off-feed.

Regardless of earlier symptoms, affected animals generally go down eventually and are unable to regain their feet without help. Once down, an affected ewe is apt to pull her head around to her flank, like a cow with milk fever. Grinding of teeth and fast breathing are apt to be seen at this stage. Stricken animals are apt to be extremely thirsty, with frequent urination a common symptom. This is in marked contrast to bowel movements, for constipation is the rule in these cases. The final stage is represented by a death-like stupor, during which ewes may be sent into violent convulsions by almost any kind of sudden, loud noise. The ewes generally recover, if lambs are born early in an attack. Otherwise death almost invariably results, unless something is done for the animal.

Cause of pregnancy disease is still disputed, but is generally believed to be a lowering of the ewe's blood sugar, due to requirements of unborn young. This belief is supported by the fact that pregnancy disease usually appears in twin or exceptionally large, single pregnancies, that put an extra strain on the dam. It is further supported by the fact that recovery generally follows when lambs are born early in an attack to end their demands on the ewe. This association with a sugar deficiency makes pregnancy disease similar to acetonemia in dairy cows.

A great deal of experimental work has shown that feeding is closely related to pregnancy disease. A sharp reduction in feed has been shown capable of causing pregnancy disease within a week after fat ewes were subjected to the change. This is important when it is remembered that ewes that have stopped eating may continue to starve themselves even though food is plentiful. Accordingly, outbreaks of pregnancy disease frequently follow storms, feed changes, spells of extremely cold weather, and similar disturbances that sometimes affect the eating habits of sheep. Trouble in well-fed flocks can usually be traced back to something that caused the ewes to stop eating for a while. We knew of one outbreak that followed a bad scare by marauding dogs. Contrary to a once popular belief, exercise or the lack of it is no longer generally considered as having any bearing on pregnancy disease.

The diagnosis of pregnancy disease is usually not difficult, since pregnant ewes are the only animals affected. It might possibly be

confused with circling disease, since the symptoms are practically identical. However, circling disease attacks sheep of both sexes and all ages. In doubtful cases, a veterinarian can make a definite diagnosis through chemical testing of the urine. It must be done early, since the same test may also give a positive reaction when used on animals in the later stages of circling disease.

As is usually true when sheep are sick, treatment is pretty much of a gamble. However, daily feeding of a pound of molasses per ewe will help in about half the cases. The use of various laxatives may also prove helpful in relieving the constipation that generally accompanies pregnancy disease. A veterinarian will probably give sugar solution by the jugular vein as he would a cow with acetonemia. As a last resort he may decide to abort the lambs or remove them by caesarean section in order to save the ewe. Whatever is done has to be done early, if it is to do much good.

Prevention is almost entirely a matter of feeding well and keeping the ewes gaining during pregnancy, particularly during those last few critical weeks. We still see most cases of pregnancy disease in thin ewes, that have had poor feed or insufficient feed. Of course, even well-fed ewes sometimes are affected, after they have once stopped eating and forgotten to start again.

Accordingly, pregnant ewes will need a lot of watching, regardless of conditions under which they are kept. Those that stop eating will need to be coaxed into starting again as soon as possible. Sometimes it may be desirable to drench them with molasses that has been thinned with warm water. As part of the watching, it'll be a good idea to force the pregnant ewes to exercise for a short time each day. Any that are noticed as wobbling or staggering, walking in circles, acting dopey, or anti-social had better be suspected of being in the early stages of pregnancy disease. Such a practice will allow you to be a little ahead of trouble. This is important, for your chances of doing something for pregnancy disease are greatly helped by an early start. Don't wait too long to get going!

To Get the Most out of Manure on Pastures

Condensed from the Pennsylvania Farmer

J. B. R. Dickey

MANURE is high in nitrogen and potash, especially if most of the liquid is saved and got back on the land. Nitrogen is the element which stimulates the green growth of leaf and stem. That is what we are after in pasture and hay crops. Potash is needed in large amounts by the clovers, which should make up a large part of our sods if they are to do us the most good and remain productive. Commercial nitrogen on pasture is short-lived in its effect and as ordinarily used tends to stimulate the grasses mainly during the flush pasture months, when we do not need extra feed. Unless very careful management is practiced the grasses crowd out the clovers which we want to favor. Manure, in moderate applications does not seem so likely to do this. Its effect is much more noticeable throughout the summer.

In a five-year pasture experiment in north Jersey five tons of manure applied each winter, supplemented with 50 pounds each of phosphoric acid and potash, gave a very nice boost to production. In the later years of the experiment the manured plots showed a higher percentage of both little white and Ladino clover than where phosphate and potash were used alone. While the report does not say so, it is probable that production from the manured plots was relatively much higher during the short pasture months than from those receiving complete fertilizer in the spring. Grazing on these plots was carefully controlled so as to get as complete utilization as possible.

In this experiment ten tons of manure annually showed actually lower yields, and in the later years of the experiment a reduction in the percentage of both kinds of clover, compared to five tons. This may have been due to over-stimulation of the grass or to difficulty in securing complete utilization due to lowered palatability. One of the most common mistakes in manuring pasture is to open the spreader up wide—so as to get back to the barn as quickly as possible. This is almost sure to result in a difficult grazing problem the next spring and a lot of wasted grass. It seems best from all angles to put the manure on

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Pittsburgh, Pa., January 27, 1951

about as lightly as the average spreader will apply it.

Manure on pasture should certainly be supplemented with super-phosphate, preferably used in the stables so that it is thoroughly mixed with the manure and can then help to hold some of the volatile nitrogen which otherwise may escape into the air. Two hundred fifty pounds of 18 or 20 per cent super per acre per year seems adequate. This would mean about 50 pounds per load of manure. Whether it pays to use potash **in addition to manure** on pasture no experimenter has apparently troubled to find out. On bluegrass-white clover sods, and on soils which are not especially hungry for potash, it would seem like a doubtful investment and would certainly increase the cost of the treatment. With heavy producing pastures, such as Ladino and one of the tall grasses, however, it might pay to add 50 pounds of actual potash per acre, as in an 0-20-20, particularly on sandy soils in the northeastern glaciated region. Where manure is applied only every other year, pastures might profit from a phosphate-potash treatment, such as 400 pounds or more of 0-20-20 or 0-12-12, during the intervening year. The effect of manure without lime and phosphate on pasture is poor and short-lived.

One of the best and oldest Ladino-orchard grass pastures which we have been watching, sown in 1941, has had a light application of manure supplemented with super or 0-14-7 every winter since it was established. By careful grazing management and clipping, the Ladino in most years still makes up nearly 50 per cent of the mixture; just about the way we like to have it. Only five pounds of orchard grass were sown on this pasture, so that there is room for the Ladino to grow. With heavy seedings of grass manure might be more apt to crowd the clover out, but the most important single factor is to get the first growth off early.

About the best bluegrass-white clover pasture we know of has been regularly getting manure one fall and about 500 pounds of super the next for many years. Although grazed heavily with dairy cows it always seems to have plenty of growth and a wonderful green color.

Many farmers with very poor pasture have been discouraged by the slowness of improvement in the sod where only lime and super were used. Whether complete fertilizer would have brought the answer we do not know. Certainly the cost would have been higher if one got on as much phosphoric acid as seems needed in the initial dose. At least 500 pounds of 20 per cent superphosphate and the use of nitrogen

on a very thin sod would be questionable.

If a light application of manure can be added to the lime and super, probably putting the super on along with the manure at least a bag to the load the first time, the response seems invariably much more prompt and satisfactory. Many of these poor old pastures are short, not only in lime and phosphorus, but on a little of everything. Manure has some of everything in it, along with a little of all of the so-called "minor elements." Anything which a plant needs in its makeup is pretty sure to be in the manure made from feeding the plant. Manure also supplies these poor, old, depleted pastures with some of the beneficial soil bacteria which have just about passed through starvation and soil acidity. Manure also usually carries seeds of grasses and clovers which may grow and thicken up a thin pasture sod.

Many farmers make the mistake of manuring their tillable land first. Then if they have any manure left it goes on the pasture along toward spring. We all know that stock won't graze where manure has been dropped in pasture. The same thing is true for several months after we spread manure on the sod. We know that too much nitrogen reduces palatability of grass, no matter how green and succulent it makes it look. With spread manure, however, it is probably more the smell which repels the animal; or perhaps it is an instinct which warns them against the possible presence of disease germs, or insect parasites which may be associated with the solid or liquid excrement. Cattle object less to the manure of horses or sheep and very little to that of poultry. Pasture manured toward spring will be poorly grazed, which means more mowing and wasted grass. If manure must go on in the spring it would best be put on the poor banks and thin spots where it is most needed and where there is not much growth anyhow for lack of the fertility which the manure will furnish.

On Ladino-tall grass pastures, where the first growth is to be put in the silo or cut for hay, late applied manure may not be so objectionable, but if the area is to be grazed the manure should go on just as early in the fall as possible, certainly before mid-winter. This allows most of the repelling effect to disappear largely before the stock are turned out; although it is generally best to manure all of a pasture at one time to avoid "selective" grazing. Even a light manure application may also have considerable good effect in protecting the sod over winter and reducing the damage from the heaving up of white clover and Ladino runners where the pasture has been grazed closely late in the fall.

Keep Leases Up with New Farming Methods

Condensed from Iowa Farm Science

I. W. Arthur and John F. Timmons
Iowa State College

FARMING methods are changing rapidly. Yet farm leases, based largely on "what's customary," change slowly. Customary rental practices for many of the newer farming methods haven't been worked out yet.

As a result both tenants and landlords may be slow to adopt new farming methods. Often they must work out their own arrangements without the benefit of custom as a guide. So there are many variations in rental provisions to meet new farming methods.

Although there are few set patterns for carrying out many of the newer farm practices, our survey of tenants and owners shows what some of the landlords and tenants are doing to get these practices adopted on their farms. Others may find these ideas helpful in adjusting their rental arrangements to meet farming methods.

Weed Control Costs

With the coming of 2,4-D and other chemicals, the question arises as to who pays for the extra labor, chemicals and equipment used to kill weeds. Many means are being used for sharing these costs. If considerable amounts of noxious weeds are present when the tenant moves on the farm, the landlord may pay for the chemicals and custom work (if spray equipment is hired) the first year to bring the weeds under control.

Thereafter, the landlord may furnish the chemicals and the tenant the labor. If weed control is done by custom work, the landlord and tenant often share the custom cost equally. Sometimes, on a stockshare lease, spray equipment and materials are furnished jointly and the tenant furnishes the labor for spraying.

Insect Control

Spraying to control corn borers and other insects is a practice becoming more widely adopted. It involves additional costs which most leases haven't provided for.

One way landlords and tenants are sharing this cost is to split the entire cost of spraying equally when custom work is hired. If the tenant does the work, the

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Ames, Iowa, February, 1951

landlord may furnish all or half of the spray materials on a share-rented farm.

What if one of the parties doesn't pay his half of the cost? Five tenants in our survey said this was the case with their landlords who were not willing to pay half the cost of spraying for corn borers. In such instances, there may be little that can be done if the time for spraying has arrived. However, if spraying is necessary, this practice should be discussed when the farm is rented or when the lease is renewed.

Commercial Fertilizers

The use of commercial fertilizers has increased 300 per cent in Iowa during the past decade. Many Iowa farm leases don't contain proper provisions for this practice or state how costs are to be shared. In the share leases, fertilizer costs for corn were shared the same way the crop was shared in most of the cases we studied. In some cases the landlord paid for a little more than half of the fertilizer used on corn—allowing the tenant something for hauling and spreading the fertilizer.

Where commercial fertilizers were applied to small grains with legume seedings, we found all kinds of arrangements for sharing the fertilizer costs. With stock share leases fertilizer costs are usually shared 50-50. The same holds true for most crop-share deals. In some of the cash leases the landlord paid for half of the phosphate on oats and seeding to protect his investment in legume seed. Occasionally the landlord furnished all the fertilizer, and the tenant the labor for spreading. This arrangement was used where the tenant might not be on the farm long enough to get full benefit from furnishing the materials.

In most cases the landlord bought the limestone and received the PMA payment for spreading it. But in an increasing number of cases the renters with secure tenure are paying for part of the limestone. In such cases the tenant may ask for a guarantee of compensation for unused value in case he has to move before he has had full use of the lime.

Although the topography of north central Iowa—the area of our study—generally dosen't call for terracing, a few rented farms in our study had terraces. In all instances the landlords had built the terraces, and the tenants had agreed to maintain them.

Contouring

Here again, topography of north central Iowa generally doesn't call for contour farming. In the few instances where contouring was practiced, the landlord arranged for laying out the contours. If fences had to be moved, the landlord paid for all

materials, and the tenant furnished the labor. It's likely, however, that tenants would expect compensation for this labor in case they move within a year or so.

Where grass waterways were used, the landlord generally furnished the seed, fertilizer, lime and any major grading work. The tenant furnished his labor, minor grading and agreed to maintain the waterways with good tillage practices.

Combining

If a landlord received half the oats or beans, he usually paid for half the combining and half the seed oats.

However, if the landlord received two-fifths or some other share less than half the crop, the tenant usually paid all harvesting and seed costs. In a few cases, the landlord paid a harvesting cost equivalent to the share of the twine and threshing costs which was the custom when crops were harvested with binders and threshers. However, since oat yields have gone up some landlords have been asking for and getting a little better deal on the oats.

Grain Storage

Under the government crop-loan programs, acceptable storage facilities may determine whether or not benefits from these programs can be obtained.

Where there's satisfactory storage room on the farm for only 2,000 bushels of corn or beans, for example, and each party has that much grain eligible for storage, who gets the use of that storage space? Several tenants and landlords were concerned with this problem. All agreed that arrangements should be worked out at the beginning of the lease or during its renewal to meet such problems before harvest arrives.

One arrangement is to share available storage facilities the same way the crop is shared. Or if more storage space is anticipated, it may be constructed jointly with arrangements that the tenant be compensated for the unused value of his share of the investment in case he moves. Also, tenants may buy movable cribs which they can take with them when leaving the farm.

Down-Corn Problem

A combination of factors, including corn borers, use of corn pickers, dry falls and high winds, sometimes results in considerable corn on the ground at harvesting time. Although this problem isn't so serious under stock-share and cash rents, it may lead to trouble under crop-share leases.

At times this problem has been so serious that some landlords and tenants are beginning to put provisions into their leases for settling it. One method which several landlords and tenants are

using as a lease provision with considerable success is as follows:

Agree upon a "normal amount" of corn which is usually left in the field—for example, 2 to 3 bushels per acre, or some other amount both can agree on.

If the corn is shared 50-50, the tenant agrees to pay the landlord in corn or cash something less than half the estimated amount beyond the agreed-upon normal leavage. (Something "less than half" is used as a basis for settlement since the corn on the ground is frequently poorer in quality than standing corn.)

In case the tenant can harvest the down corn with livestock and dosen't want to pick it up, the amount left on the ground can be estimated by picking up or counting sample areas of corn on the ground.

Some tenants and landlords estimate this amount by counting the ears left in every tenth middle of rows and multiplying this amount by ten. Others take blocks of so many hills square as samples for estimating the amount of corn on the ground.

However, the important point is to find a workable procedure for settling the problem before a difference arises and include the procedure in the lease.

Other Adjustments

In case these methods don't seem suited to a particular situation, it might be desirable to "ask around" and find landlords and tenants in the community who have developed satisfactory arrangements. *But be sure to find out if the arrangement is tied up with or conditioned by other parts of the lease.* Obtain a complete account of the arrangements. Usually it is not possible to take individual items in two leases and compare them directly. Oftentimes their handling is tied to some other agreement in the lease.

As a general rule it's best to anticipate new practices and methods and provide for them in the lease. Then if the practice is adopted each party knows what his responsibilities will be.

Chemical Weed Control Equipment

Condensed from American Agriculturist

John VanGeluwe and Ernest Marshall

WEEDS and brush present a problem on every type of farm in the Northeast, whether it be in corn, grain, vegetable crops, or even in the commercial orchard.

Then phenomenal growth of chemical weed control practices which has taken place during the past few years has markedly changed cultivations and farming practices in many areas of the United States. During the next few years, northeastern farmers will see even more rapid advances in chemical weed control. Out of this will come a demand for more and better equipment built especially for chemical weed and brush control. The conventional spray to which farmers were accustomed was designed for high-gallonage, high-pressure spraying of fruits and vegetables. Such equipment was not versatile enough to handle the different demands placed on sprayers by new chemical weed control practices.

Many of the new weed killers are of the hormone type, and for safe use have to be applied at very low gallonage rates, such as 5–6 gallons per acre. Thus a demand was placed upon industry to develop sprayers capable of applying these low gallonages. They also had to be able to apply higher gallonages when used with weed killers which need greater amounts of water as carriers for most effective action. The challenge to industry was accepted, and today we have equipment designed especially for this type of work.

Breaking this equipment down we find four principal parts—pump, tank, boom and nozzles. Each part has several points which must be taken into consideration.

THE PUMP is the heart of the system. It controls the pressure and volume of material being used. Several points are very important when considering the pump for sprayers which are to be used for weed control work. It should be made of non-corrosive metal and, in the Northeast, it should be versatile enough to handle gallonages varying from 2 to 40 gallons per acre. The pump must be built so that its efficiency does not drop off too rapidly after some use. These

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Ithaca, New York, March 3, 1951

pumps vary in the manner in which they are attached to the outfit. They may be driven direct from the power take off, by a V-belt attachment, or by a separate gasoline motor. In general, pumps are of four types: rotary, centrifugal, rubber impeller, and piston type. Information concerning them can be obtained by writing companies that handle the various types.

THE TANK or tanks act as the reservoir. It is desirable to have the tank large enough so it need not be refilled too often. It must be made of metal, preferably non-corrosive metal. On the farm, standard 55-gallon drums are often used for this purpose. Wooden tanks should never be used for weed control sprayers, since it is practically impossible to clean thoroughly the hormone type weed killers from them.

THE BOOM needs to be constructed relatively rigid so that it does not swing or whip during operations on rough or hilly ground. A good type of boom is one that is both folding and adjustable, so that it can be easily transported and readily adjusted in height above the ground. The boom may be mounted either in front or behind the tractor. A rear mounted boom is generally preferable because vapors and fumes of the materials being applied will not bother the operator.

THE NOZZLES most generally used on weed control equipment have a flat spray pattern. This type of nozzle gives a uniform pattern and thorough coverage. Volume of application can be changed by changing either the complete nozzles, or in some cases, just the replaceable tips. Complete lines of nozzles of different angles, volumes and types are carried by several suppliers. These same suppliers publish charts showing rates of speeds to use and type and size of nozzles for various weed control jobs.

Ground sprayers can be mounted on several pieces of equipment. The most common method is to mount the sprayer on the farm tractor. This usually requires the least investment. Large commercial operators very often use jeep or trailer mounted sprayers. Some types of weed sprayers are mounted on a separate chassis and are fixed so that they can be attached to a tractor or jeep as a trailer unit. This type of sprayer sometimes has a separate engine to drive the pump.

Those, in general, are the basic requirements for weed control equipment. Weed control machinery is relatively inexpensive when compared with most other farm implements.

Uses for these sprayers will increase so that with the inevitable expansion of chemical weed control, they will be a multi-purpose machine suitable for use on many

crops and for many purposes. Every year new crops are added to the list that can be sprayed for weed control. As new materials are introduced, the farm weed sprayer will become an indispensable piece of farm equipment.

Last year, army worms invaded southwestern New York State in large numbers and threatened to destroy crops in that area. Sufficient conventional spraying equipment was not available to the farmers in the area and was too expensive to purchase for that one outbreak. However, there were local supplies of inexpensive weed sprayers available which the farmers purchased and used effectively to combat the threatened disaster.

Low volume equipment also appears to have a future in the application of concentrate insecticides. Work conducted by various experiment stations indicates that certain insects can be controlled with insecticides applied in low volumes of water and under low pressure. It is forseeable that in the future large areas of forage crops will be sprayed for insect control with this type of equipment. High volume application is not feasible so that, of necessity, low volume equipment will be used. Thus the low volume weed sprayer will become more and more a very profitable piece of farm machinery.

During this and the next few years the northeastern farmer can profitably consider weed spraying and the equipment that accompanies such an operation. This offers an excellent method to conserve farm labor. It is exceedingly important that a farmer examine the equipment available and correlate this with his individual needs. He must purchase the equipment which most suitably fits his current and future needs in weed control and low volume spraying.

Turkey Fryers

Condensed from American Poultry Journal

James Joseph

LEO M. OLSEN was one of those turkey growers who didn't like the idea of circling two dates on the calendar—Thanksgiving and Christmas—and staking his fortunes on them. Instead, he vowed to make everyday fare out of holiday birds. The solution was the turkey fryer.

That was in 1947, just after he quit the U. S. Forest Service and leased 10 acres of land atop San Marcos Pass, outside of Santa Barbara, Calif.

He didn't have a lot of capital; what he did have was tied-up in his flock of 1500 birds. One day he heard that a few farsighted growers were trying to lift turkey-raising out of its seasonal rut. They were selling 12-week old turkeys, weighing 5½ to 6 lbs., as fryers, and getting their money out all-year-around.

He straight-way decided to stage a one-man crusade, a door-to-door canvass. By retailing to housewives, he could realize more profits and at the same time carry the word of the turkey-fryer right into the kitchen .

First, he did some serious research. He cut up some of his 12-week old birds and asked his wife to experiment in her kitchen. Mrs. Olsen discovered that turkey fryers are at their best when fried or barbecued. Roasted, young turkeys lose their flavor. This culinary research gave Olsen valuable data. He would be able to advise housewives how to pan fry the young birds; how to barbecue them over an open fire; how to prepare them for cold turkey barbecue.

Olsen chose young toms as fryers because they shot up first among the poults, matured faster, and by 12 weeks, were just about the desired fryer weight. Likewise, some on-the-farm cost-accounting showed that 12-week-old toms put on more weight in proportion to the feed bill than hens.

He found that poults hatched in late January could be offered as fryers in March and April. By spacing hatchery dates, he could be assured a supply of 12-week old toms, ready and primed for market from April to September. After September, he could concentrate on fattening up the remaining birds for the holidays.

So he mapped a production

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chart, geared to deliver 6 different batches of poults. He bought 500 poults the first of February; set 2400 eggs 9 days later, timed to hatch the first week in March; other batches were hatched in mid-April, the first of May, the end of May, and the last batch early in July. Spaced batches would put his birds on a production basis and assure him plenty of fryers.

He found it was best to segregate the batches—which meant additional brooder houses. He got around this problem of additional brooder house expense by buying 4 army surplus hospital tents 16 × 50 ft. in size for $250 each. After the tents, he turns his birds out under the oak trees to pasture.

Before he began his one-man turkey fryer crusade. Olsen took a trip into town and surveyed leading groceries. He discovered that by selling direct to the housewife he could market fryers for only about a dime more per pound than chickens.

He also noticed the self-service departments in various groceries: how, for instance, chickens were cut up, placed in paper boats and wrapped in cellophane. Conversation with a packaging firm salesman revealed that it's best to wrap poultry in laminated plastic bags for deep-freeze storage; and in cellophane for lower-temperature refrigeration.

So, if the housewife planned to refrigerate her fryer, Olsen slipped the paperboat inside a cellophane bag; if the fryer was destined for the deep freeze, he used laminated plastic.

Either combination had sales appeal, presenting a clean appetizing appearance. With the turkey fryers packaged like that, Olsen figured he'd meet less sales resistance when he took the birds house-to-house.

On the farm, he dresses his turkey fryers the day before delivery. He bought an 8 × 12 ft. walk-in box, chilled to 32–35 degrees F. by a 2 h.p. compressor. The same compressor chills a tank of circulating water which receives the fresh-killed tom fryers. The birds remain in the cold water for about two hours to take the heat out of them, and then they're hung in the cold box over night.

Next day, they're disjointed into 13 pieces to a bird and placed in the neat, sanitary paper boats and covered with cellophane wrapping. In short, the fryers are "pan-ready"—a phrase which has become a catch-line.

Olsen delivers on Tuesdays and Fridays.

"There's a reason for these delivery days," he says. "Tuesday and Friday deliveries are timed to arrive a day ahead of the usual Wednesday and Saturday parties."

Even this bit of merchandis-

ing astuteness came from personal research. He asked a half dozen housewives when they entertained, and since most of them answered. "Wednesday and Saturday," he timed his deliveries for the day before.

Olsen's one-man turkey fryer crusade begins in the spring. He places one and two column, 2-inch ads in the daily Santa Barbara paper.

About ⅔ of his turkeys, including fryers, are sold direct to housewives. And since 1947, Olsen has steadily upped his flocks. Last year, for instance, he raised 4500 birds—three times the number he raised his first year in the fryer business.

His advertisements, though relatively small, take advantage of space. "Turkey Fryer" always heads the ad in large black type. Then the ads go on to stress that they're "Pan-Ready."

Has he made everyday fare out of holiday birds? "It looks that way," admits Olsen, and his eyes light up with a crusader's zeal. "It's because turkey fryers have a taste all their own."

Ways To Correct Soil Deficiency

Condensed from Better Fruit

Dr. R. E. Stephenson, Soil Scientist
Oregon State College

ADEQUATE use of commercial fertilizers when needed on most crops increases yields, improves quality and is highly profitable. Wrong use cannot only fail to show profit, but may cause harm and a reduction in yields. Therefore, there is importance to the correct diagnosis and sound recommendations for a particular crop on a specific soil.

Since the soil supports the plant, it is necessary to know which soil properties are of most significance and something of how adequate is the capacity of the soil to provide the favorable properties. These properties are chemical, physical, and biological, all of which are critically important to plant production.

Important physical properties, such as soil structure, may be either overlooked or undervalued. A mellow sponge structure, where most of the small particles of

Reprinted by permission from Better Fruit, Portland, Oregon, August 1950

sand, silt and clay are aggregated into crumbs and water stable granules, varying perhaps from pinhead to pea size, is ideal for most crops.

Such a structure makes the soil easy to cultivate, favors profuse root development with roots that function efficiently, and allows quick penetration of water into the soil with good drainage and aeration, all of which are conducive to good growth and a satisfactory harvest.

This favorable structure is associated with the medium to lighter textures such as loams and sandy loams. These soils usually do not have more than 10 to 15 per cent of clay and they do not readily form clods or cement into hard compact masses.

Texture cannot be changed but the structure possessed by any given texture can be made worse or better according to management. Loss of a porous granular structure, called the "key to soil fertility" may be as disastrous as lack of nutrients in the soil.

Excessive cultivation and humus depletion destroy the granular structure, whereas reduced tillage and increased humus renewal improve structure. The grower who fails to appreciate the significance of texture and structure in the soil will overlook an important crop yield factor.

Effective soil depth (the depth to which plant roots can penetrate and function), is an easily overlooked but important physical property of soils. The proper appraisal of soil depth is especially important in choosing a suitable crop for a particular soil so that a plant which requires 10 feet or more of depth will not be chosen for a three-foot soil. Such inappropriate crop selections are too frequently made.

Biological properties, also easily overlooked in the soil, are important to the production of crops. Good soils contain a host of useful organisms, bacteria, fungi, and animal organisms such as earthworms, which are important in enabling the crop to obtain nutrients for growth.

Organic matter is decomposed by this host of organisms and in the process nutrients are liberated and made available to plants. For example, in the absence of organisms, nitrogen in any appreciable amounts would not be introduced into the soil by the processes of nature, nor would much nitrogen in the form of nitrate or ammonia become available to plants even when organic matter is abundant.

Availability of all nutrients to plants is considerably dependent upon activity of soil organisms. Soil conditions must be made favorable for the activity of the beneficial organisms while at the same time steps should be taken to discourage or eliminate such pests

as wireworms, cutworms, and symphylids.

When low nitrogen organic materials, such as straw, are worked into the soil, the temporary depressing effect upon plant growth is due to activity of soil organisms causing the straw to rot. They are using all the available nitrogen for their own sustenance during the rotting process.

Use of a nitrogen fertilizer in an amount adequate to feed both the soil organisms and the crop solves this problem and makes it possible to use any low nitrogen material, even sawdust, for humus renewal.

That chemical properties of the soil are important to the growth of plants is never questioned. Reaction of the soil (whether acid, neutral or alkaline) may determine which crop will best succeed and sometimes whether any crop can be profitably grown.

The most favorable reaction for the largest number of plants is near neutral. Availability of essential nutrient elements is always important, as is also absence of excessive amounts of elements which may prove injurious to plants or animals.

Not only the soil but the plant must be considered in deciding upon the right fertilizer or soil treatment to use. Legumes and nonlegumes do not have the same requirements, nor would fruit trees and vegetables have the same needs.

A plant which must make growth and be ready for harvest quickly (six weeks to 90 days sometimes) must have a readily available fertilizer. A clover or alfalfa field or a tree may have several months to absorb the nutrients it needs and can thus use a slower acting fertilizer.

The plant grown for protein forage (pasture) likely will not require the same type of fertilizer as the plant grown for starch or sugar (potatoes, beets). Plants grown for succulence and tender fiber (lettuce, cabbage) need more nitrogen than would a crop (berries) where succulence or softness would interfere with shipping qualities.

Thus the most suitable fertilizer treatment for producing a crop depends in part upon what is the desirable attribute (yield, composition, shipping qualities, or other things) to produce in the crop.

The specific physiology of the plant must be considered. For example, strawberries differentiate fruit buds beginning a month or two after harvest and continuing through the fall. Fertilizer, therefore, must be applied long enough before this period for the plant to have absorbed the needed nutrients so their influence may be effective in fruit bud formation. Immediately after harvest, if there

is moisture, would appear to be an appropriate time for effective use of fertilizer on strawberries. Without irrigation, the fertilizer may need to be applied before harvest.

The kind and amount of fertilizer to use are likewise influenced by physiology of the plant as it is related to the desired end product. Large doses of nitrogen make a plant vegetative, a condition desirable in cabbage but not to such an extent in fruit production.

A cherry tree with excessive nitrogen fertilization tends to produce new growth and foliage with sometimes a reduced set, slow ripening, and poor coloring of fruit. Phosphate is important in seed formation as in grain production, but much less important in the apple orchard.

Importance of soil moisture cannot be overlooked in the fertilizer program. Fertilizer in dry soil has no effect, because moisture is required to dissolve the material and carry it into the plant.

Since fertilizer causes increased growth, probably more moisture will be required throughout the growth period of the crop if the fertilizer is to become most effective. Liberal use of fertilizer with too little water can cause burn and decreased crop production.

How then shall we diagnose needs of the crop and limitations of the soil to correct unfavorable soil conditions and to improve the harvest? Not by considering one thing alone, but by recognizing and improving, so far as reasonably possible, all things that govern the harvest.

A clinic composed of experts in all phases of plant production should prove most successful in diagnostic procedures which must precede an effective corrective measure.

Chemical methods used on both the soil and the plant are helpful in the hands of an experienced interpreter. In the hands of the novice they are of little value—may in fact prove detrimental.

Expert chemists have striven earnestly to develop methods suitable for use on soils to determine whether there is an adequacy or a deficiency of certain elements. The acidity test is good for determining whether a soil may need liming for certain crops that have a high lime requirement and do best on soils that are near neutral in reaction.

Available phosphorous in the soil can be determined with some degree of success. Available potassium can be determined with perhaps greater assurance than a mere guess. There are no satisfactory methods for determining deficiencies of several plant nutrient elements, including most of the minor ones.

What about the total analyses

of the soil? The amount of any element present in the soil can be determined by a good chemist with a reasonable degree of accuracy. These analyses will indicate whether a soil has a large or small or just average amount of any particular element. They do not indicate anything about how much nitrogen, phosphorous, potassium or any other of the 11 or 12 necessary elements the plant may be able to take from the soil.

Total analyses, therefore, are of little help in deciding upon what fertilizer to use on any particular soil or crop.

The chemist can also analyze the plant quite accurately for any element about which he may desire information. But a total analysis of the plant is not too helpful when it is known that plants vary widely in composition even when there is no deficiency or excess of nutrient.

For example, Chapman (California) finds in analyzing orange leaves that high producing orchards may vary in leaf composition over wide ranges, so that the low for nitrogen is less than two-thirds of the high. This relationship for other elements is half for phosphorus, two-thirds for sulphur, half for magnesium, one-fourth for manganese and zinc, and one-fifth for boron, comparing the low with the high amount found in the leaves from high producing orchards.

Since the orchards were high producers, it must be assumed that the low amounts were adequate. Only when the total of any element contained in the foliage was appreciably less than the low of high producing orchards would the chemical analysis indicate a possible need for that particular element, and this was only an indication, not a sure test for deficiency.

Chemists have developed special quick methods for use on both plants and soils to indicate which elements are deficient and to serve as a diagnostic guide in making fertilizer recommendations. All such methods to be of much value must be standardized against field trials to determine at what levels of nutrients as indicated by the chemical tests may be associated with a crop response in the field when the indicated fertilizer is used.

There are, therefore, no chemical methods that are infallible but if suitable methods are used understandingly, they are helpful. Any good information about the properties of the soil that influence its productivity is helpful in deciding on the right fertilizer treatments or other management practices.

In making a fertilizer recommendation it is essential not only to know what to use, but how,

when, and where to apply it to get good results. Soluble fertilizers applied on the seed may prevent germination or if applied on the plant may cause severe burn. A safe application is usually a few inches to each side for row crops and preferably four inches or more deep in the soil (deep enough to rest in moist soil).

Phosphates should not be mixed with the soil because mixing increases fixation which renders the phosphorus unavailable to the crop. Any fertilizer wrongly used can prove useless or even harmful to the crop. Detection of the deficiency, therefore, is only part of the problem in making a diagnosis and recommendation for fertilizer treatment.

Where greenhouse space is available, quick trials in the greenhouse using a suitable indicator plant may serve to point out nutrient deficiencies in the soil more effectively than chemical tests can indicate. Greenhouse tests (under proper supervision) can be used to check any nutrient deficiency, including both major and minor elements.

These tests can be made in small cans, varying from one quart to a gallon in size, used as soil containers for growing the plants. Sunflower plants are a good general indicator to use because they grow quickly to give the needed answer.

The final and deciding test is always in the field with the crop that it is desired to produce. Field tests can be made on small plots, such as one rod square or 25 feet of row, to get results without excessive effort or expense. A small plot can show as definite a response to a given treatment as larger areas and may make it unnecessary to purchase a large quantity of some fertilizer or material from which there is no return.

Diagnosis of soil and plant troubles, therefore, is neither simple nor easy. In an attempted diagnosis, identification of the soil type should be the first step. A knowledge of the soil type alone may be sufficient to decide such important questions as whether physical or chemical properties are more likely to limit production, and which crops may be planted with a reasonable chance for a good harvest.

A knowledge of the past treatment of the soil, fertilizers used, crops grown, yields obtained, and any other pertinent data is helpful in deciding upon present fertilizer needs, desirable crops to grow, and management practices to follow.

No general information can quite take the place of personal examination of the soil in the field. The diagnostician can then study the effective depth, observe tillage pans if present, and other

things that are important but easily overlooked.

Chemical tests may or may not seem necessary but, if needed, they should be made. The acidity test alone is of considerable value not entirely because the test may indicate whether lime is needed for certain crops, but also because the reaction of the soil may give an indication of the availability of other nutrients.

The California station found that 79 per cent of 105 soils with a pH below 5.9 were low in available phosphorus (greenhouse test with Romaine lettuce) but only 26 per cent of 116 soils near neutral in reaction were low in available phosphorus. In eastern Oregon, alkali, which might be the cause of trouble, could be easily spotted with chemical tests.

But whatever chemical tests are made on either soil or plants, there are a number of things that these tests cannot show, some of which are entirely outside the soil, such as the presence of diseases or insects which do damage that no fertilizer can correct.

Even if a suitable fertilizer is the principal need, the chemical test cannot be relied upon with complete assurance.

After considering the known facts relative to soil testing, we find it necessary to agree with Proebsting of California, who, after a discussion of the use of nitrogen fertilizers on deciduous orchards, closes with the statement, "Field trials remain the most accurate method of diagnosis, but are slow and require supervision."

Gypsum Improves Wet Soils

Condensed from Crops & Soils

David A. Ririe and W. A. Mitcheltree
Rutgers University

AGRICULTURAL gypsum has had a long and interesting history.

It has been credited with being beneficial to certain crop plants, notably the clovers. Part of its value is probably due to the nutrients, calcium and sulfur, that it supplies to the plants, and part to its good effect on the physical properties of the soil.

We will not discuss the nutrient

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value of gypsum in this article, but its effect on the improvement of soil structure and drainage of soils is a very timely topic.

Although very little research work dealing with the use of gypsum on poorly-drained soil has been done, its beneficial effect in "loosening up" tight clays is well known. By combining the tiny clay particles into larger aggregates, it often improves the soil tilth and increases the movement of air and water through the soil.

Two Rutgers University scientists, J. S. Joffee and W. C. Krueger, were the first to suggest the use of gypsum as an amendment for wet soils in the New Jersey area.

In certain parts of this state, farmers have long been troubled with localized wet areas, which are often referred to as "surface swamps." These depressions, which often lack natural drainage-ways, are apt to be in the middle of large fields, and the crop in these spots is frequently a total loss.

With continuous cultivation, loss of soil organic matter and indifferent cropping practices, the drainage in some of these areas became slower and slower. Fine soil particles often washed down into these depressions, filling the natural pore space of the soils and making the situation still worse.

In 1947 a survey of New Jersey farmers showed that many of them considered these wet spots to be one of their most serious soil problems. New Jersey soils men were quick to act, and a large-scale demonstration program was undertaken in the fall of that year. Gypsum was applied to wet spots on some 60 farms.

Among these was the Hulse potato farm near Cranbury, N. J., where an application at the rate of 2 tons per acre proved very effective. This particular farm had two low areas that had long been unproductive because of poor drainage. Even though the soil was a good Sassafras sandy loam with excellent under-drainage, the water collected in these spots after every sizable rain, and they were very slow to dry out in the spring.

By digging down into the soil, a tight, silt-filled layer was found. It was probably caused by runoff from the surrounding slopes.

Gypsum was applied in the fall. A year later no sign of poor internal drainage was found in the soil profile, and an excellent potato crop was harvested from the land. This was in striking contrast to previous years, when potatoes were a complete failure. The spring and summer of that year were extremely wet, which made the results even more outstanding.

On the Kirvan farm near Allentown, N. J., the yield of wheat was increased from 24.2 to

43.1 bushels per acre, following the use of gypsum at the rate of 2 pounds per square yard. The yield of straw was increased from 2,250 to 4,985 pounds per acre on the same area.

Equally successful results were obtained from smaller amounts in a number of other places in the state.

A farmer in Passaic County was so pleased with the effects of gypsum in improving the tilth of his soil that he wanted to apply the material to his entire farm. Whether such a practice would be practical has yet to be determined.

Gypsum is certainly not a "cure all" for poor drainage conditions. To illustrate this point, some unsuccessful cases will be examined, such as the one on the Campbell farm near Hightstown, N. J.

Examination of a wet spot on this farm seemed to indicate that it would be a good place to demonstrate the value of gypsum, but the application proved to be a failure. Under the clay-silt layer, which at first sight appeared to be the one causing the poor drainage, there is a layer of sand. The individual particles of this sand were later found to have flattened surfaces, fitting together so closely that the pore space between them was almost nil.

Since gypsum does not promote the formation of aggregates in sand, it was valueless in this trial.

Another unsuccessful case occurred in Somerset County, N. J. Examination of the soil in this field revealed the presence of a very dense clay layer underneath 24 to 30 inches of silt. Beneath the clay was some loose, shale-like material that would probably have carried the water away. But apparently the water could not penetrate to this depth. At any rate, gypsum had no effect on the drainage of this spot, and it remained swampy.

The results from the use of gypsum have been very promising thus far. More information is needed, particularly on the amount of gypsum that is needed for best results, and on how long a period gypsum applications are effective.

Consideration should also be given to the possible value of gypsum in improving soil tilth and water intake on a wide scale in other areas.

Red Sindhi Dairy Cattle

Condensed from Kansas Farmer

Ed Rupp

MULE-EARED, hump-shouldered dairy cattle. How would you like to see them on your farm? They are being developed by the USDA to withstand the high temperatures and humidity of the South. But there is a possibility that these Brahman-crossed cattle will show desirable characteristics for colder climates too.

At Beltsville, Md., Red Sindhi are being crossed with Jersey. In Louisiana, Red Sindhi are being crossed with Brown Swiss, Holstein and Jerseys. And in Texas local Brahman females are being crossed with Jersey sires.

The Red Sindhi breed, which is being used by the USDA, is one of the more popular milking strains of the many breeds of Brahmans or humped cattle in India. A start with this breeding program was obtained in 1946 when the Bureau of Dairy Industry obtained 2 Red Sindhi heifers and 2 Red Sindhi bulls from India in exchange for some Beltsville Jerseys.

But it takes a long time for a cross-breeding experiment of this nature to show results. It takes a long time to get a sufficient number of cattle with different ratios of crossbreeding. After that more time is required to see how those cattle will react under normal farm conditions.

The bureau of animal industry is now nearly ready to begin work with second-generation cattle.

There seems to be very desirable uniformity in the cattle which the bureau has at Beltsville. And the milk production characteristics seem quite satisfactory. Of course, both those points should be expected as the Jerseys used are of good quality and the Red Sindhi animals had better than average backgrounds for milk production. For example, the sire or one of the bulls and one of the cows acquired by the Bureau of Dairy Industry is out of the registered cow "Sindhi Queen," which made 3 yearly records averaging 7,488 pounds of milk, testing 4.5 per cent butterfat. That would be about 327 pounds of fat. Average production of all cows in the United States in 1948 was about 5,000 pounds of milk.

Along with the mule-ear, sloping rump, shoulder hump and large dewlap characteristics

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Topeka, Kansas, March 3, 1951

which show in the crossbred cattle, there also is a persistent horn characteristic. Just a normal dose of caustic on the horns of the crossbred calf makes little change in horn growth. A double dose stunts the horn, but doesn't stop it.

Crosses will be made to obtain animals carrying ¼, ⅜ and ¾ Red Sindhi breeding. These cattle will be subjected to various tests to determine what breeding methods will best combine the heat-resistance characteristics of the Red Sindhi and the milking qualities of Jersey, Brown Swiss and Holstein breeds. After the best combination is determined, of course, attempts will be made to improve crossbred strains.

While all this is going on efforts will be made to determine the physiological secrets of heat tolerance. A temperature control room is being used for determining which crosses can best tolerate the higher temperatures. In this room they will see how little Red Sindhi blood is needed in the crossbred to give desirable tolerance.

The Red Sindhi does have heat tolerance. So do the crossbred cattle. And the Jersey seems to have a little more tolerance for heat than the Holstein. But when placed in the heat chamber, the body temperature of Jerseys and Holsteins went up 6 or 7 degrees in comparison with an increase of body temperature of only 2 or 3 degrees for the Red Sindhi-Jersey cross.

Some believe this heat tolerance is due to the large amount of loose-fitting skin carried by Brahman cattle. But Roy C. Jones, with the Bureau of Dairy Industry at Beltsville, says definitely it is due to the ability of the Brahman cattle to sweat. Our European breeds of cattle cannot sweat.

That ability to perspire means much to the average dairyman. Cows drop off in milk production when heat becomes intense. Lactating Jerseys placed in the heat chamber have been dried up in just a few days. Under those conditions they would neither eat nor drink.

We saw 12 Sindhi-Jersey crossed heifers in production at Beltsville. Two had just started in production. But 10 had been in milk an average of 186.6 days. Average milk production to that time was 5,226 pounds with an average fat production of 296 pounds.

On a 305-day basis that would mean an average of 8,542 pounds of milk and 484 pounds of fat. And that is for first-calf heifers.

There are today a little less than 100 of these Red Sindhi crossed cattle in the nation.

T O Ranch

Condensed from The Cattleman

Garlon A. Harper

"Our job is to convert range grass into good feeder cattle," says M. H. Miller, manager of New Mexico's famed T O Ranch. Judging from the show record of T O bred steers and their performance in commercial feedlots, Mr. Miller and his cowhands have been doing their job well.

Almost traditional are the winning habits of carlot fat steers bred by the T O Ranch and fed by Karl Hoffman. The years they do not win, such as at the last International, only seem to be the exception that proves the rule. And, at the last show, a T O steer out of the feedlot of a Texas 4-H Club boy was made grand champion at the International and kept the T O in the beef fattening spotlight.

Success of T O bred feeder calves in commercial feedlots, where cattle are fed for the profit they will make, is equal to that of the show steers. Nearly all feeders of T O calves are repeat customers. You don't have to tell a ranchman that this means satisfaction.

Behind this story of success in the feedlot and at the shows lies a story of top ranch management and good cattle breeding. The short, thick and lowest type of cattle found on the ranch is the result of years of intensive breeding under the direction of that master cattleman, Ed Johnson. Today, Slim Miller continues this constructive breeding program and practices ranch management which has one objective—"produce feeder calves which will make money for the feeder and friends for the Ranch." A day at the ranch with Slim is a rare pleasure from the time you drink that first steaming cup of coffee with the "boys" until the last pasture has been "caked" and the last windmill checked.

This 140,000-acre birthplace of champions is located just below the Raton Pass in the foothills of the Rockies. The size of the herd varies with prospective grass conditions each year. This usually means about 3,000 mother cows. During the very poor years there may be several hundred fewer cows on the ranch or several hundred more replacement heifers may be kept when conditions appear extra good.

Proper care of the grass is the

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Fort Worth, Texas

first consideration. Although they try to stock with the ideal number of cows, they understock if there is any question about the carrying capacity for the coming year. Slim says that since they are actually selling range grass it is necessary to keep that grass in condition for top production next year and ten years from now. Through careful location of watering and salting places and by changing winter feeding grounds, they are able to secure an even distribution of grazing over the entire ranch.

Natural springs have been developed for best use and conservation of water supply. Ponds were constructed to catch excess runoff water and the overflow from springs and wells. Windmills are located so cattle will have only a short distance to travel to water. Wells and windmills are fitted with identical equipment so that a piece of pipe or an extra part which fits one well may be used for any other well on the ranch.

Replacement heifers are selected while they are still nursing. This enables Slim definitely to identify the calf with its mother and also provides an opportunity to see if the future brood cow is the right kind individually for their principal market—feeder calf sale. Only calves which are out of cows that breed regularly and produce enough milk to raise a good calf are selected for herd replacement. After initial selection, the heifers are placed in a separate pasture where they are grown out well. Then final selections are made from this group on the basis of type and development.

Slim is strong in his belief that adequate supplemental feeding is necessary for production of more and better calves and to take proper care of range forage. Usually, he feeds an average of two and one-half pounds of cottonseed cake or soybean cake, per head daily, during the winter season but this amount will vary with weather and forage conditions.

While this amount is higher than the average fed on ranches in that area, he feels that each dollar he spends on supplemental feed returns the ranch an average of two dollars. Like all cattlemen, he wants cows to calve regularly; produce a strong calf and give enough milk to get it off to a flying start. He thinks that a high protein supplement does this because it furnishes the protein which is needed to make the most effective use of the dry winter grass on the range. Adequate supplemental winter feed keeps the cows in good condition to start the spring season on new grass and lengthens the useful lifetime of the range cow. At the ranch, they have noticed that if supplemental feed is not given when snow is on the ground, cows are

inclined to bed down and not get out for enough water and grazing. When the cows are caked they come out for the feed and immediately go after water and then forage for a fill of the dry grass.

Slim likes lots of protein in the winter supplement because he feels that it helps to develop a strong calf which is not so large at birth to cause calving trouble. He says that if a calf is strong at birth and the cow gives lots of milk the calf will be heavy at weaning time. Average weights of T O calves at selling time are 400-pound calves from heifers; 450 to 500-pound calves from three-year-old cows; and 475 to 550-pound calves from older cows.

Special emphasis is placed on proper handling to prepare calves for the feedlot and get them ready to settle down and go to work for their new owners. The calves are dehorned and castrated while they are young and are handled easily to avoid scaring and "buggering." Before sale they are shaped up into uniform lots.

Because of the Ranch's special effort to produce and handle calves to please feedlot buyers, it has many customers who buy their calves year after year and never see the calves until they are unloaded into the feedlots. Slim keeps in close contact with feeders of T O calves and frequently makes trips to observe the calves on feed and obtain suggestions from the feeders on ways to improve their service.

Slim has a twinkle in his eye as he talks to you about cattle and you instinctively know that here is a man who loves and understands cattle. Like many good cattlemen, he feels that a cow can tell you what she wants if you know how to speak her language.

One cold February morning I rode out into a pasture with Slim to "cake" a herd of 650 commercial cows. As we got over the ridge into the pasture Slim began blowing the horn on the pickup. You could look in every direction and see trails of cattle slowly winding over those grass covered hills where volcanoes were active thousands of years ago. The cows were not in a hurry. They knew Slim would wait until they all gathered in. But as the last cow ambled lazily into the feeding area, Slim started the pickup and the cows rushed to pick up the cake as it streamed out on the grass.

How To Figure The Right Rotation

Condensed from Capper's Farmer

Francis A. Kutish
Iowa State College

EVERY year farmers wrestle with the problem of how much hay and pasture they should have in their cropping rotation.

Each farm has a separate answer to the question: "When does it pay to grow forage—when doesn't it pay?" For there is no single "best" combination of forage with other crops in a rotation, even for the same soil conditions!

That's why 2 Iowa State College scientists joined forces to try to find some useful measure of when a forage crop is profitable in the rotation. They are Earl O. Heady, farm management research specialist, and G. M. Browning, professor of agronomy.

They wanted to find the correct profit principles — considering prices, the use of crops for livestock feed, and the need for a "continuing" high level of production. Once those profit principles were found, they could be applied to actual conditions on any farm.

Forage crops have 3 important values: (1) They improve soil structure and add nitrogen and organic matter to it; (2) They help cut down erosion losses; (3) They make excellent feed for livestock. Few farmers could get along without some roughage.

The root systems which add nitrogen and organic matter to the soil, boost the yield of corn, wheat and other crops which follow. This increase is a "yield" from your forage crop just as surely as the hay you put up or the pasture your animals graze.

Farmers recognize the soil-building qualities of forage crops. But they also know that the average acre of forage produces less in feed value than an average acre of corn or of wheat. So the farmer who makes the most money over the long pull must find some balance between high producing corn or wheat and soil improving forage in his rotation.

Heady and Browning figured that such a balance or compromise will depend largely upon 3 relationships: (1) The effect that grain and forage crops in the rotation have upon the yield and production of each other; (2) The amount of forage crops you can

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Topeka, Kansas, August 1950

substitute for grain in feeding livestock; (3) The price of grain compared with forage and the cost of producing each.

Tests of different rotations show that *up to a point,* adding forage to the rotation will boost the total amount of grain produced from your land. Farmers know this from experience, too. Land grained year after year doesn't give very high yields. On most land. adding some forage to the rotation will raise grain yields enough to increase total grain output.

Heady and Browning refer to this relationship between grain and forage as "complementary." That is, increasing the forage in your rotation also increases total production of corn and small grain. They believe that many farmers operate in this complementary range today. They could boost their long-run grain output by raising more forage.

There's an important principle here. You cannot afford to raise less forage than will give you this highest output of grain. Even if forage has no cash or feed value on your farm, you can still plow it under as green manure and reap higher grain yields from the added fertility.

Landlords operating under crop-share leases sometimes restrict their tenants' acreage of hay and pasture. But it will never pay a landlord to restrict forage acreage below the amount that gives highest grain output. A landlord could afford to let the tenant raise that much forage *rent-free* rather than restrict acreage. The increased total grain output will give both him and his tenant a higher return.

This profit "principle" doesn't tell us exactly what this high grain output combination of grain and forage is, Heady and Browning say. That depends upon conditions on your farm. Some soils can stand a good deal of grain cropping. Others may need a high proportion of forage crops in the rotation to maintain high grain output.

Sooner or later—as you include more forage in the rotation—forage crops become "competitive" with grain. Grain yields continue to increase with added forage. But the increase in grain yields is not large enough to make up for the loss in number of acres planted to grain.

This relationship begins with the rotation giving highest grain output. It remains competitive as you shift to more and more forage. Including more forage in the rotation now reduces your total output of grain. But total production in terms of feed units may continue to rise.

Total feed output goes up as long as each acre of forage added to the rotation produces more feed units than you lose from the

drop in total grain output.

As more and more roughage is produced, grain yields get less of a boost from it. Some rotation will give you highest total feed production, including your forage yields. Beyond this point, including more forage in your rotation may lower the total amount of livestock feed produced.

For any single year grain and forage will always be competitive —the more forage you raise the less grain you can produce in that year. Thus tenants, operating under 1-year lease, often raise mostly grain. They stand to gain nothing from the fertility benefits of forage.

As the proportion of roughage is increased beyond this point, total feed production as well as grain output goes down. The end of this range is complete grassland farming.

Here again Heady and Browning are speaking in terms of principles. These general relationships apply to all farms. But the exact rotation that gives highest output of total grain or total feed may be quite different for each farm. No 2 farms will be exactly alike.

Thus, as principles, we have these 2 fundamental relationships between grain and forage in every rotation: Grain and forage are "complementary" up to a point of maximum grain output; beyond this the added forage becomes "competitive" with the grain.

Under no circumstances will it ever pay to use a rotation with less forage than will give you maximum grain output. It will always pay you to operate in the competitive range.

If crop prices were your only guide, you would produce a combination of hay and grain that would give you the highest income from sale of both. And this is a fairly good yardstick, even for livestock farmers. Prices fluctuate a good deal from year to year. But in the long run they represent the value of the various crops as livestock feed fairly well.

Thus Heady and Browning point out that over the last 20 years the price of a pound of grain has averaged about 2½ times the price of a pound of hay. (The 1928–47 average price for corn was $1 and for hay 40 cents per 100 pounds.) At this price relationship you would plan a rotation to yield an average of 2½ times as much hay per acre as corn, measured by weight.

If by increasing your forage acreage you get back only 3 tons (6,000 pounds) of hay for each 50 bushels (2,800 pounds) of corn you give up, then you would be giving up $28 of grain and getting back only $24 in hay. If on the other hand, you get back 4 tons (8,000 pounds) of hay in place of 50 bushels (2,800 pounds) of

corn by increasing your hay acreage, then you are exchanging $28 in grain for $32 worth of hay.

Using prices in this manner tells you what combination of crops will give you the highest dollar value of production. If you make allowances for your harvesting and other costs, this method can show you which rotation gives the highest net income in terms of cash prices.

The cash grain farmer will always use this method—bushel for corn, wheat and oats, and price per ton for hay or rent per acre for pasture. Livestock farmers, too, can employ this measure. Most farmers plan to use their crops as feed for livestock. If prices are out of line with your own feed supplies, you can often sell one kind of feed and buy back another in order to get the most economical combination of feeds.

Where erosion is a problem, raising forage may not always be the most economical way to hold your soil. Terracing, strip cropping and other practices may give you the needed erosion control. Then you could have a more profitable rotation on the same land without serious soil losses.

The principles Heady and Browning have suggested can help you find the right rotation for the particular conditions on your farm. There's always a rotation that gives you the highest grain output. In the long run you'll never gain from producing less forage than this rotation calls for. There's also a rotation that gives you the highest output of feed.

By careful figuring you probably can judge about what these rotations are for your farm. Then, on the basis of prices, feeding efficiency, and the organization of your farm business, pick the rotation which you think offers the most profit in the long run.

Yield Tripled

Pastures at the LaCrosse soil conservation experiment station that were torn up with a field cultivator, fertilized and seeded with medium red clover, alfalfa and brome grass yielded exactly three times as much dry forage as adjoining bluegrass pastures. The bluegrass yield was one ton per acre. The grass-legume mixture yielded three tons per acre.

The Farmer

Minor Elements—A Major Problem In Orchards

Condensed from New Jersey Farm and Garden

Dr. Norman F. Childers
Rutgers University

Two years ago we started to look into the problem of why yields and quality of New Jersey tree fruits, particularly apples, have been on the downgrade for several years. Most of us realize that it is becoming increasingly difficult for the average fruit grower to make what he considers a decent net profit.

It is well established that the most important factor influencing net profit from an orchard is *yield of quality fruit per acre.* It costs about as much to spray and manage an acre of trees with a heavy crop as one with a moderate to light crop. Our aim has been to try to learn how to get good crops of fruit almost every year under both North and South Jersey conditions, which are decidedly different from the standpoint of soil and climate. Over 30 fruit growers are co-operating with us and we believe we have made some progress.

Our approach to the problem is mainly through an improved fertilization program, which we believe is the quickest and most practical answer. We also are carrying an active breeding program for improved varieties of apples, peaches, and other fruits; but it takes a little time to get these established on a commercial basis.

Since New Jersey growers have been using nitrogen, phosphorus, and potassium in substantial quantities for 50 years or more, we have asumed that the orchards contain adequate quantities of (particularly) phosphorous and potassium; that if growth is poor it may be due to an excess of one of these elements, or due to a deficiency of any one of several of the other known elements essential for plant growth.

The nutrients to which we are paying most attention are magnesium, boron, zinc, copper, manganese, iron, and, in some cases, molybdenum. Any one of these elements is just as essential to plant growth as nitrogen and, if deficient, the effect on tree growth, production, and quality will be as detrimental as a deficiency of nitrogen—in some cases, far more detrimental. Deficiencies of boron, zinc, and

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Sea Isle City, New Jersey, December 1950

copper, for example, can be much more harmful than a deficiency of nitrogen. The fruit may not only be small, misshapen, russetted, puffy, cracked, and with poor flavor and quality, but limbs and roots may die. In fact, the entire tree may gradually decline until it dies or is pulled.

From studies thus far we know we have deficiencies of magnesium, boron, and zinc. We are suspicious of copper deficiency. With peaches, we know we may have a deficiency of manganese under some conditions. In addition, we are suspicious that some of our apple trees are showing manganese deficiency; but as yet we have not had time to establish a specific test.

With apples, we have devoted most of our time to zinc deficiency because we know it is generally present in New Jersey orchards. In some orchards the trees are almost dead from zinc deficiency or they are yielding small crops of poor quality fruit. Our finding of zinc deficiency in peach orchards last year and in apple orchards this year is the first instance on tree fruits which has been noted in the Northeastern states. In fact, very little attention has been given to zinc deficiency east of the Rocky Mountains, because pomologists dealing with deciduous fruits have thought that it was not a problem in this area.

Probably the reason that we have not seen much zinc deficiency in past years is because a number of states east of the Rockies have used a small amount of zinc in cover sprays as a safener for arsenic. Its presence apparently served also as a nutrient. The entomologists knew that the foliage looked better, particularly at the end of the season, where zinc had been included with the arsenic. However, according to Dr. Byrley Driggers, New Jersey has never used zinc sulfate as an arsenic safener for apples. This may be the reason that the New Jersey orchards are showing relatively more zinc deficiency at this time.

The substantial use of phosphorus by New Jersey growers also may be responsible, to some extent, for an aggravation of zinc deficiency. There are considerable data from Florida and other states which show that where phosphorus is high in the soil there is likely to be a zinc shortage in fruit trees. Phosphorus is required much less by fruit trees than by legumes, vegetables, and grain crops. It is probable that we have been using too much phosphorus in our fertilizer formulas for fruit, the most common of which are 3-12-6, 5-10-5, and 4-12-8.

Canada came to the conclusion several years ago that the phosphorus in these formulas is too high, so now they recommend a

9-5-7 and base their decision on considerable research information from many countries which show that phosphorus almost could be considered a minor element for fruit trees. In New York, Ohio, and most of the New England and Middle West states, nitrogen is the only element that has been recommended and used in orchards.

The New Jersey Station in general has recommended about 500 to 800 pounds per acre of a complete fertilizer broadcast in spring, and additional nitrogen, if needed, in June in a band under each tree, using sodium nitrate, ammonium nitrate, ammonium sulfate, or similar sources. Many of the growers, however, realizing that they needed somewhat more fertilizer than 500 pounds of a complete mixture, have been using more and more of the complete mixture, up to as much as 1,500 pounds per acre, and applying it all at once in the spring. This saves the trouble and expense of the extra application of nitrogen in June.

By this practice, however, it is probable that these growers have used a little too much phosphorus; perhaps, in some cases, also too much potassium. We know that excessive use of potassium fertilizer may cause a magnesium deficiency in the tree.

Deficiencies of some of the nutrients may be developed in the tree despite the fact that there are rather substantial quantities of these nutrients in the soil. We had this situation demonstrated rather clearly last summer in a test we were conducting in an orchard near Minotola. We used sufficient replications of individual trees, with buffer or check trees on all sides, and applied to the test trees all essential nutrients except the one in question and ran the gauntlet of five minor nutrients, namely, manganese, boron, zinc, copper, and iron. Supposedly adequate quantities of the other elements, such as nitrogen, phosphorus, potassium, and magnesium, were given to all test trees. (Molybdenum was not included in this study.)

We were able to develop in the second season of the experiment a deficiency of the particular nutrient under test. It seems that the fruit will show these deficiencies first. In fact, the trees all looked good, with little or no difference in color and growth characteristics. When we omitted zinc, copper, or boron from the fertilizer mixture, these elements seemed to have the greatest effect on date of ripening and fruit color. When boron was omitted, the fruit ripened from two to four weeks later than fruit on trees of the same variety which received all of the essential nutrients. Also, fruit on trees receiving complete nutrients ripened two to three

weeks ahead of nearby trees of the same variety receiving the grower's standard fertilizer program.

Zinc deficiency had almost as much effect as boron deficiency on the date of ripening and color of the fruit. When copper was left out of the fertilizer mixture, ripening was delayed a week or so and the quality of the fruit seemed poorer. We are checking this situation further next year, but it appeared that on the copper deficient trees there were many more split pits. As a result, brown rot, gnats, June beetles, and other insects were more prevalent.

All minor elements studied (including also iron and manganese) reduced fruit color and delayed ripening from a few days to a few weeks. This was particularly surprising in case of iron, since we thought the soils and ground water were well supplied with this element in South Jersey.

We have known for many years that the heavy use of nitrogen in orchards is often accompanied by a delay in ripening and poor fruit coloring. From our work with peaches last summer, we wonder if this may be due to a disturbance of the balance in the tree between nitrogen and, for example, boron or zinc. This would induce a semi-deficiency of these nutrients in the tree and fruit, even though there may be a rather good supply of them in the soil.

In some of our experiments in North Jersey near Belvidere the past season, we found that we can apply as much as 25 pounds of sodium nitrate alone to Rome Beauty, Stayman Winesap, and Delicious trees with little or no harm, except for a delay in ripening and coloring of the fruit. Fruits on these trees, however, were obviously of larger size than where we used 10 pounds of sodium nitrate per tree. This was particularly true for Rome Beauty.

Where we applied 10 or 15 pounds of sodium nitrate per Stayman, Rome, and Delicious tree on our Station grounds last summer, we induced much better leaf growth for the early part of the season, but during September and October we had a heavy leaf drop and poor coloring and sizing of the fruits. This probably was due to the fact that the inherent fertility of the soil in Central Jersey is not as good as that in North Jersey.

Thus, from our preliminary tests near Belvidere, it appears that some of our orchard soils in North Jersey may be quite similar to those in New York and Pennsylvania. In this area it may be possible to use only nitrogen in the fertilizer in most years, thus reducing the bill for phosphorus and potassium. In fact, better

yields of better fruit may be obtained in these orchards by using relatively more nitrogen than has been recommended, and by applying it by hand in a ring under the trees.

We believe best results will be obtained in these soils with 10 pounds per tree of sodium nitrate for Rome and Staymen. Fifteen pounds might be used on Delicious. However, we got the best response on Delicious with 25 pounds of sodium nitrate per tree, although the cost of the fertilizer may not have been justified.

At this point in our nutritional studies, we thought it desirable to test a special fertilizer mixture containing both the major and minor elements. Last spring we used one of these special mixes in two apple orchards (one near Englishtown and the other near Middlebush) and two peach orchards (near Burlington) on from one to four acres each.

At Englishtown, on a medium- to light-textured soil, we obtained better fruit set and obviously larger, greener leaves (and more of them) where the special mix was used, compared with a 3-12-6 containing boron on trees nearby of the same varieties (Delicious and Golden Delicious). There was a little difference in nitrogen application between these two plots, with the special mix block receiving the equivalent of about a half pound more of ammonium sulfate per tree. It is doubtful, however, if this amount of ammonium sulfate per tree would make the rather outstanding difference between these two blocks.

The better condition of the orchard receiving the special mix fertilizer probably was due to the magnesium, copper, and/or manganese, since both blocks received boron. The special mix fertilizer also included 50 pounds of zinc sulfate to the acre, but it is doubtful that this was worth while, since some trees were still showing moderate to severe zinc deficiency.

It is known generally that zinc is a very difficult element to get into the tree through the soil under some conditions, because some soils "tie it up" tightly so that the tree roots cannot get it. This fall we are applying zinc sulfate to this block as a post-harvest foliage spray at the rate of four pounds of zinc sulfate and six pounds of hydrated lime in 100 gallons of water. In March we will apply also a dormant zinc sulfate spray to these trees about two to three weeks before the buds break, using 25 pounds of zinc sulfate in 100 gallons of water. This is the procedure used in the State of Washington for correcting zinc deficiency in Delicious where it has become a definite problem. It may be necessary to continue these applications on an annual or bi-annual basis.

HOW TO DETECT ZINC DEFICIENCY

Leaves appearing on a zinc deficient tree in spring will be very small, narrow, and frequently with wavy margins. They may show a whitish-green chlorosis between the main veins. On the older wood, numerous rosettes or tufts of these small, narrow leaves will occur. There will be much bare wood, due to inability of the side buds to push on the previous year's wood.

As the season progresses, there may be fairly good shoot growth at the terminals of zinc-deficient trees, but the amount of this growth will be limited. The fruit tends to be small, pointed, and poorly colored, but the quality may not be greatly affected. Some fruits on the tree may be of good size. Tops of zinc-deficient trees are thin, with long weaving limbs and shoots, due to inability of most of the lateral buds to push in recent years. The number of fruits in the upper third or half of the tree may be limited, while the lower two-thirds or half of the tree will be carrying a fairly good crop and the foliage also will be moderately thick in this region of the tree.

Obviously, if only half or two-thirds of the tree is carrying a crop, it should be possible to lift the yield by a third or half again by the use of zinc. We have not had time as yet to show the effect of applications of zinc over two or three years on yield, color, and individual size of the fruits. We do know, however, that the use of zinc in citrus orchards in California and Florida has had a tremendous effect on yield, size of fruits, and quality. It is probable that we will obtain similar results with apples and peaches.

Reorganization Would Pay

Condensed from Agricultural Situation

Silas B. Weeks and G. E. Frick
Bureau of Agricultural Economics, U. S. D. A.

MANY DAIRYMEN in New England could increase their net incomes from $500 to $1,000 per year at current price levels by making full use of the latest and best technical information.

This is one of the conclusions of the first of a series of studies dealing with production efficiency on family dairy farms requiring the labor of one to three men. Although the study, which was financed under the Research and Marketing Act, was made in New England, the results probably apply in general to dairy farms elsewhere in the United States.

Greatest opportunities for increasing net income lie in applying the latest technology on a broad scale rather than in piecemeal changes. Many farmers have adopted single improvements such as new legume mixtures, heavier rates of fertilization or the rapid milking technique. Few of them, however, have attempted a thorough reorganization of all phases of production and management. Broad adjustments are generally needed. Yields of hay and pasture tend to be low and the forage produced is frequently of poor quality. Forage crops usually consist of grass mixtures grown in long rotations. Use of fertilizers, particularly commercial fertilizers and lime, is at low levels. Farm buildings and equipment are often outmoded, making it difficult to use labor efficiently.

The adjustments open to New England dairymen fall into four major groups:

1. Improvement in forage production.

This includes the latest recommendations of the agronomists on seeding and the use of fertilizer. Many of these practices result in higher yields, improved quality and better seasonal distribution of forages. They permit the farm to carry more livestock without depleting soil resources.

2. Changes in forage harvesting methods.

Increased forage production could be handled without increasing the farm's labor force by using newer machines, such as the field pick-up baler and the field forage harvester, and by relying

Reprinted from Agricultural Situation,
Washington, D. C., February 1951

more heavily on custom hired work. Mow finishing of hay, according to preliminary research results, will provide 5 to 10 per cent more milk per acre of forage than regular field curing methods. The increase may be as high as 40 per cent in comparison with field cured hay that has been rained on.

3. Improved chore practices.

Adoption of the fast milking technique would help many dairymen cut the time required for chores. Changes in the order in which jobs are done, in the way work is done, in the layout of farm buildings, and the arrangement of equipment often can cut labor requirements per cow nearly a third.

4. Improved livestock management.

Changes in breeding, feeding, rearing, disease control and other practices when coupled with better quality forage will result in larger output of milk per cow.

With full use of the latest technology on family dairy farms in New England, it is estimated that milk production per farm could be raised 20 to 45 per cent by increasing both cow numbers and production per cow. This could be done without any increase in land and labor. The increase in investment in equipment, buildings and other resources would not be large.

An idea of how a broad reorganization of a dairy farm might work out can be obtained by comparing a typical two-man farm as it is today with the way it might be after the latest in technology had been applied. This typical farm has 26 cows (herds from 10 to 29 cows produce the bulk of the milk in New England), 9 heifers 1 year old and over, 9 calves, and 1 bull. There is a team of horses, though the farm also is equipped with a tractor. Sixty-nine acres are in crops and 120 acres in permament pasture. Regular labor used on the farm amounts to 1¾ man-years while 0.15 of one man-year of seasonal labor is hired.

Herd management would get a lot of attention during reorganization. Improvements in the way barn chores are handled and adoption of the rapid milking technique will make it possible to cut chore time from 100 hours per year per cow to 88. Less chore time also will be required for replacement stock. Better disease control, more rigid culling and more cow comfort will raise the average herd life from 3 years to 5 years. The horses will be sold.

These changes will make it possible to handle 34 cows with the same amount of labor now required for 26.

More cows will require more feed so the farm's cropping program also will get plenty of attention. More legumes will be used

in the hay mixture. Rotations will be shorter and more fertilizer will be used. Corn will get 12 tons of manure and 250 pounds of 5–10–10 commercial fertilizer per acre at planting. Mixed ladino seedings will receive 2 tons of lime, plus 10 tons of manure and 500 pounds of superphosphate. All hay will receive an annual top dressing of either 10 tons of manure per acre amended with 250 pounds of superphosphate or 600 pound of 0–14–14 fertilizer. Suitable areas of permanent pasture will be improved and treated every third year with 8 tons of manure and 400 pounds of superphosphate and with 1 ton of lime every 7 years.

As a result of these practices, production of forage would increase about one-fourth. Use of hired custom equipment for corn planting and harvesting, and pasturing more of the farm forage would prevent any increase in labor requirement.

Some additional equipment would be purchased during reorganization. A fan and electric motor would be needed for barn finishing the hay. One more single unit milker would be required as well as a larger milk cooler. Part of the cost would be offset by selling some of the horsedrawn equipment. The net addition to investment in equipment would be about $300.

Changes in barn facilities also would be needed although they will be small.

Ducts would have to be built in the mows to barn finish the hay. Stable space formerly used by the horses would be remodeled for cows. Silo capacity would be increased. All in all, these changes would amount to an additional investment of about $1,500.

After reorganization milk production per cow would be at least a tenth higher than before. This would result from improvement through breeding, increased cow comfort, better disease control and better quality of young stock as well as better distribution of pasturage throughout the season, and a higher quality of both hay and pasture. Since the farm would have eight more cows, total output of milk from the farm will increase about 45 per cent. The amount of land and labor used would remain the same, and changes in the amounts of equipment, buildings and other resources would not be large.

Along with the increase in productivity under the reorganization, the farmer would find a noticeable improvement in his income. Assuming prices received and cost rates at about current levels, the net income would be $1,035 higher than under the old plan. Most of the increase in income would result from the gain in farm output. Costs per 100

pounds of milk produced probably would not be reduced greatly, though a reduction of about 10 per cent is likely.

The farm we have been discussing is not a particular farm. It is a farm typical of many in New England. Production of crops and livestock on this farm, before and after reorganization, is based on conditions typical of the area. Costs and income are figured by assuming prices at about current levels. However, this "typical farm" example gives New England dairymen a good idea of what they can expect from a broad, well-planned organization. Each farmer would have to plan according to his particular circumstances.

In planning a reorganization, a farmer will find it worth while to get the opinions of agronomists, dairy nutritionists, farm management specialists, and other experts. Because of the broad scope of his plan, the more information he gets, the better will be his chances for success.

New Soil Testing Service

Condensed from The Ohio Farmer

Dean H. Mayberry

THE new soil inventory laboratory operated by the Department of Agronomy and the Agricultural Extension Service of the Ohio State University has been operating for several months. During that time it has tested about 1200 soil samples from 85 of Ohio's 88 counties. At present, 40 to 50 samples are arriving from county agricultural agents' offices every day. Thus the laboratory will test 800 to 1000 more soil samples in another month.

F. J. Salter, agronomist in charge of soil testing, has called the laboratory "the best soil testing facilities science can offer." Tests for lime, phosphate and potash needs are included in the new inventory. Soil type is completely identified and organic matter content is given on a percentage basis. This much of the test is included in what the laboratory terms the "standard group" and costs $1. Two additional groups, costing $2 each, include tests for trace elements and tests suited to greenhouse soils.

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This is the first time such complete service has been offered in Ohio. The new inventory tests for more elements also expresses results in pounds of available nutrients per acre. Salter points out this "will mean much more than high, medium or low." Once a farmer has a complete inventory of a field, he can feel that he knows that field's requirements for about 6 years, or 2 rotations.

To obtain a soil test a farmer must work through his county agricultural agent. Laboratory instructions in the form of a pamphlet, Taking Stock of Our Soil, emphasizes that only samples correctly chosen and "channeled through the local county extension office will receive attention."

County agricultural agents have copies of the instruction pamphlet and stand ready to help farmers obtain a soil inventory. When a farmer reaches the county agent's office with soil samples, the two men fill out a "record of area" sheet if they have not completed it earlier. This information might be compared to what a patient tells a doctor before receiving treatment.

Information in the "record of area" tells the position, drainage characteristics, slope and past treatment of the field being tested. With the soil samples, this record and other forms are mailed to the laboratory. After tests are complete, agronomists fill in the forms with recommended practices as well as with actual test results.

Recommendations tell how often a sod crop should be grown to put needed organic matter into the soil. Rate of liming to neutralize soil acidity and another rate to maintain a neutral condition are recommended. Fertilizer recommendations for permanent grassland, row crops, drill crops and meadows include amounts and times of application. Last recommendation is the kind of rotation agronomists believe best for the field tested.

Results of the tests with recommendations are mailed to the county agent who helps farmers plan farming operations to conform to advice as far as possible.

Information now collected at the university already points to some general observations. Seventy per cent of the soils tested thus far are low in phosphorus and potassium for maximum production.

"Many soils have reached the critical point," Salter says. They have only 15 to 20 pounds of available phosphorus per acre when 75 pounds is the minimum amount needed. Many soils have less than 100 pounds of available potassium per acre. They should have at least 200 pounds per acre for adequate supply.

Most samples show a need for lime in some amount and organic

matter test results simply point out what agronomists have known and recommended all along. "Those farmers who have failed to maintain sod crops in their rotations need to give attention to organic matter," says Salter.

The need for following instructions and asking advice in taking soil samples is emphasized. Some samples coming into the laboratory show evidence of including more than one soil type. Others have not been correctly dried—in fact, laboratory technicians recently received two bags of mud through the mail.

Too rapid drying "ruins the behavior of the soil for purposes of analysis." Instructions are to dry soil in sunshine or at room temperatures.

The Mighty Atom

Condensed from American Fruit Grower

Elwood G. Fisher
Cornell University

THE ancient alchemist in his mysterious laboratory dreamed of converting base to noble metals. Advancements in the field of nuclear physics have shown us that such a conversion of one element to another does actually occur; and today scientists working with radioactive material are taking advantage of the fact that as such a change occurs certain particles or energies are liberated which can then be measured by Geiger counters or ionization chambers. For instance, radioactive carbon slowly changes to a stable form of nitrogen, and radioactive cobalt slowly changes to stable nickel.

It is not the point here to discuss all the technical difficulties involved in the use of radioactive isotopes, but merely to illustrate that there are limitations to the use of this new tool. The farsighted policy of the Atomic Energy Commission has helped to overcome some of these difficulties. Since the end of World War II they have done much to make radioactive elements and compounds available and to train scientists in techniques and safe handling of such materials.

Two important elements from the standpoint of plant and fruit research are nitrogen and magnesium. The radioactive forms of

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these elements have such short half lives, a matter of minutes or seconds, that their use in plant research is impossible. There are stable isotopes of these elements which could be traced by a mass spectroscope, but this is another new tool of plant research and will not be discussed here.

Potassium is another element important in plant research, but radioactive potassium has a half life of only about 22 hours. Its use is limited, therefore, and must be carried on close to the source of radioactive material.

Despite these limitations in the use of radioactive isotopes for plant research, considerable information is being obtained from their use and much more will undoubtedly be obtained in the near future. Radioactive materials are utilized by the plant in the same manner as non-radioactive materials. Their passage through plants can be traced by measuring the emission of particles or rays and can be detected in amounts considerably smaller than by refined micro-chemical methods.

Radioactive phosphorus was one of the first elements to be used in plant research. It continues to be a widely used radioactive material in all biological studies. A very important use is its application to fertilizer investigations. One of the first studies on phosphorus availability came from the University of Hawaii. In the past few years the USDA has done much work studying the use of radioactive phosphorus in soils, factors affecting its availability, and the soil chemistry involved. Phosphorus studies are being undertaken in the citrus soils of California to determine what factors regulate the absorption of phosphorus and how phosphorus is related to the problem of supplying micro-nutrients to the tree.

Investigations have been carried on with grapevines to determine the effect of fertilizer placement on phosphorus uptake. Much more phosphorus was taken up by the vine as a result of deep placement than following surface application. In fact, 43 days after surface application 86 per cent of the applied radioactivity was still in the top six inches of soil, even after heavy irrigation. Radioactive phosphorus has been used to study the spread of grapevine root systems, a much less laborious way than the old method of excavation.

By means of radioactive phosphorus in fertilizers it is possible to calculate what proportion of phosphorus increase in the plant has come from the applied fertilizer. Interestingly enough, increases in phosphorus in the plant have not always been found to come directly from the applied fertilizer itself. Another study from Purdue indicated that tomato plants in nutrient solution

fertilized with urea absorbed phosphorus faster than plants furnished nitrogen as nitrates.

It is possible that by the use of this new tool more information concerning viruses of fruit trees may develop. Radioactive phosphorus has been incorporated into tobacco mosaic virus and the translocation and breakdown of the virus when injected into a tobacco plant has been studied.

Since phosphorus is present in amino acids, proteins, nucleo-proteins and materials of energy transfer in plants, radioactive phosphorus will undoubtedly play a large part in both fundamental and practical research with plants.

Along with radioactive phosphorus, radioactive carbon is of extreme importance. The use of carbon dioxide with "tagged carbon" has led to considerable advancement of the fundamental knowledge of the process of photosynthesis.

At Cornell we have done some research on spraying fruit trees with urea for the purpose of nitrogen fertilization. We became interested in the possibilities of urea tagged with radioactive carbon as a means of studying the rates and methods of urea penetration, translocation, conversion, and use. One important technique with radioactive materials which appears extremely useful is the use of autoradiograms; i.e., radioactive material placed near a photographic plate will take its own picture and show in what tissue of the plant it may be located or concentrated.

Using radioactive carbon or iodine in hormones and weed killers, rates of penetration and translocation have been followed. A marked effect of spreaders on rates of 2,4-D penetration has been found.

Radioactive calcium is being used at Cornell to study the chemistry of soil liming practices, and radioactive sulfur has been used at the University of California to study spray or dust injury caused by applications of sulfur to citrus foliage. At the State College of Washington, radioactive iron and phosphorus are being used to study chlorosis in plants. Materials such as radioactive cobalt have been used to trace the feeding habits and habitats of insects. Out of such investigations may come improved insect control programs.

The use of radioactive material for fruit research and related fields is still in the infant stage. But it certainly is a field where the use of atomic energy can bear fruitful results, perhaps first of all in fundamental knowledge, but also eventually in practical fruit production.

Underground War

Condensed from The Farmer

THERE have been spectacular results from the treating of some kinds of legume seed. There have been good results from treating others. All results from the research work of Dr. M. F. Kernkamp, plant pathologist at University Farm, St. Paul, indicate that seed treating is good and cheap insurance and that alfalfa, the clovers, soybeans and grass seed will make much better stands if treated.

Observations from results obtained lead to this statement from R. C. Rose, extension plant pathologist at University Farm: "The soybean belt can be shoved 100 miles farther north as a result of seed treating."

And what is the basis for that statement? In a recent experiment sixty-two per cent of the treated beans pushed plants through the soil surface while only 32% of the untreated pushed through.

Having no protection the untreated seed was attacked by tiny bacterial enemies even before soil moisture had softened the seed coat. Then when the seed coat was softened and plant growth started the seedling was weak and the underground enemies kept right on boring in.

The organisms of seedling plant diseases get in their most telling licks in cool soil, during backward seasons, and against seed of low germination, or with cracked seed coats. Mr. Rose tells of an experience which emphasizes this fact.

J. Russell Gute, Steele County Agent, wanted an exhibit to show the effects of treating. He treated a sample of beans, planted it, and then planted an untreated sample. To get quick germination he placed the two greenhouse flats on a radiator. Because conditions were perfect on that radiator there was quick germination, and emergence from the untreated seed was nearly equal to that from the treated. It occurred to Mr. Gute that if the beans had been planted under field conditions the seed might perform differently. The next batch of seed was kept in a cool place. Then the results were like those described above. Obviously, since these seed protectants kill disease organisms and thus prevent seed rot and seedling diseases in cool soil, soybeans can be planted in cool soil with greater assurance that they will come through and make a crop.

Although alfalfa seed and the

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Saint Paul, Minnesota, February 17, 1951

seed of grasses do not respond to treatment as spectacularly as soybeans, they respond enough to make seed treatment profitable. This is particularly true of damaged seed. Dr. Kernkamp wanted to know just how great a response there would be from the treating of badly damaged alfalfa and sweet clover seed. None of the untreated damaged seed produced a plant. With one of the treating materials there was a 44% emergence of the alfalfa and 40% emergence of the sweet clover.

Since it wouldn't be the misfortune of many farmers to get seed as badly damaged as the seed with which Dr. Kernkamp deliberately experimented, a more practical trial, he reasoned, would be with the ordinary run of seed which farmers plant. Accordingly he got 14 samples from growers. Emergence of untreated alfalfa and sweet clover from these lots averaged 49% for the alfalfa and 73% for the sweet clover, while the emergence of treated alfalfa was 56%, of treated clover, 78%.

Further proof of the rule that the poorer the conditions for germination the better the results from seed treating came of a depth of planting trial which Dr. Kernkamp conducted. Alfalfa and red clover seed of good quality was planted an inch deep and one-eighth inch deep. There was little difference in the percentage of emergence of the shallow planted seed. Emergence was satisfactory with both lots, but of the deep planted, untreated alfalfa seed only 30% emerged while 48% of the treated alfalfa emerged. The difference between treated and untreated seed emergence was much less in the case of the red clover. There was some difference, however—5% in favor of treating with one material, 3% with another.

The two materials which gave good results in the treating of both legumes and grass seed were Arasan and Spergon. On soybean seed the rate of application is two ounces per bushel with either material. On alfalfa, the clovers, or grass seed, the application rate is eight ounces per 100 pounds with either material.

Either Arasan or Spergon may be applied as a dry powder, or as a wettable powder mixed with water and the seed treated by the slurry method. Many Upper Midwest elevators and seed houses are equipped to treat seed and will do it almost as cheaply and perhaps better than the work can be done at home. If such service isn't available, the dry powder may be applied at home in an old barrel churn, home built seed treater, or even in a discarded milk can.

Neither material will affect nodulation of the legume plants. Inoculate treated seed just before planting.

Because treating legume seed is a new practice attention is focused on it this season, and while plant disease specialists are urging farmers to treat legumes they are also urging that the treating of other kinds of seed not be overlooked.

Treating of seed wheat is especially important. It will help get seedling plants off to a fast start. Although of itself seed treating has no effect on rust, the earlier emergence of seedlings as a result of treating, followed by the earlier maturity of the crop, may be helpful. Even a difference of five or six days which may result from a combination of treating, applying superhosphate fertilizer, and early seeding may get the crop in a safe position before rust strikes.

Emphasized by the plant disease specialists is this simple fact: Seed treating won't make a weak seed strong, but it will surround the weak seed with enough protection to permit it to produce a plant.

Crossbred Lambs Make Efficient Gains

Condensed from Indiana Farmers Guide

J. P. Hoekzema

SHEEP numbers have been steadily decreasing. With wool prices firm, lamb prices holding up very well, with interest high in grassland farming and with the demand for lamb being unfilled the reason why sheep numbers have declined is hard to explain.

The decline has been fairly constant over the country. Ohio has always produced large numbers of sheep. Possibly because of this she has realized her problem and has started to do something about it.

D. S. Bell, sheep specialist at the Ohio Experiment Station at Wooster has been working on this problem for years. He said, "Sheep, from among all classes of farm livestock, are the most extensive users of grass. For the nation about 92 per cent of the feed for sheep comes from meadows and pasture, with 80 per cent coming from pastures alone. By comparison, 64 per cent of the total feed for dairy cattle comes from pastures and meadows with only 38 per cent from pastures alone. Beef cattle obtain 73 per cent of their total feed from pas-

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tures and meadows with 60 per cent from pastures alone. In the sheep business, grass and its efficient utilization is fundamental."

Many commercial producers have learned that good western ewes, either white-faced or black-faced ewes, have given very fine results when crossed with good mutton rams. These western ewes are usually crossbred ewes and when crossed with a mutton ram make a three-way cross.

Bell knew that the foundation of the western flocks, as well as of most of the Ohio flocks, was the Merino breed. He reasoned that if beef or dairy or other breeds were the solution to the decreasing numbers of Merinos that they should have taken over. This had not occurred.

Several different experiments were organized to see which type of sheep was best adapted to grassland farming. It was also thought that the size of the sire might influence the size of the lamb. Infant mortality has been, and is, a very important problem, so studies about this were also included. Different pasture grasses and combinations have also been tried to see which will give the best results with sheep. Some grasses and legumes give fine results for cattle but others may do better for sheep.

In order to make use of the Merino sheep that were present in southern Ohio Bell used this breed as a foundation. On these ewes were crossed Corriedale, Columbia and Merino rams. Also mutton rams were used on western ewes to make further comparisons. The latter gave the best results in numbers of ewes bred, number of lambs raised, number of lambs weaned, total pounds of lamb weaned and average weight of lamb and amount of lamb produced per ewe in the flock.

It was believed that some of the fine results obtained from the western ewes was the result of crossbreeding. In order to make a more complete comparison a straight Merino flock, Corriedale-Merino ewes (crossbred white-faced ewes) mated to Hampshire and Suffolk rams; Columbia-Merino ewes mated to Hampshire and Suffolk rams; western ewes mated to similar mutton rams and a Merino flock mated to Hampshire and Suffolk rams were used.

The Columbia-Merino ewes mated to the mutton rams gave the best results in number of lambs born, number of lambs weaned, per cent of lambs raised to the number of ewes in the flock, average pounds of lambs per ewe and also in total pounds of lamb at weaning time. This amounted to 2,884 pounds as compared with 2,144 pounds for the next nearest flock, which was the western ewes mated to the mutton rams.

The Columbia-Merino ewes mated to large-size mutton rams have given the best results to date. Bell thinks that one reason for this is that this cross is 50–50 for large size and when mated to a large-size ram the lambs are 75–25 for large-size. He believes that it is important to know how the ewe flock is bred so as to best know the type of rams to use for best results.

Sheep producers are interested in getting the largest number of pounds of lamb per ewe, providing the price of that lamb will be at or near the top of the market.

A very interesting test was conducted at the Ohio Experiment Station. Three comparable lots of the Columbia-Merino ewes were bred to three different rams. One lot was mated to a small-size ram (Southdown), another lot to a medium-size ram (Dorset) and the third lot to a large ram (Suffolk).

The results from the first test are very interesting. Only single lambs were considered though the twins showed similar trends. During the nursing period (130 days) the medium-size lambs produced 112.7 pounds of lamb and the large lambs produced 116.6 pounds lamb for each 100 pounds made by the small lambs.

In the grazing period which followed weaning the lambs sired by the medium size sire on grass alone produced 141 pounds lamb gain and the lambs sired by the large ram produced 189 pounds of lamb for each 100 pounds made by the small size breed sire.

Similar results were obtained when comparable lots were fed corn on pasture after weaning. These tests seem to show that the size of the sire is of marked importance in establishing rate of gain, pounds produced and time of marketing. Bell emphasizes that these ewes were 50-50 for large size, and similar results might not occur in all flocks of sheep.

Infant mortality is closely associated with cull lambs, according to work done at this station. Bell thinks that many of the cull lambs are that way because they failed to die when very young. These tests indicate that infant mortality is due to inheritance or breeding as most of it is eliminated when crossing two or three breeds. When the third breed ram was used on cross-bred ewes infant mortality declined to as little as zero and very few cull lambs occurred.

These tests are being conducted to determine how to make the sheep business most efficient. Bell said, "We believe that good purebred sheep are very important in obtaining the best commercial lambs. For instance, we used purebred Merino ewes, and a pure-

bred Columbia ram to get our white-faced ewes. We have been able to get ninety to one hundred pound lambs off from grass using a good purebred Suffolk ram on these ewes. We are basing our breeding work on using purebreds."

Ever Hear of an Aluminum Mulch?

Pulling weeds may soon become a lost art (unless war steps in with its shortages).

How's that? With aluminum foil—you cover the ground completely between the rows, and not a weed can poke through.

But that's only a part of the story. Stuff grows faster. Cantaloupes at the Virginia Truck Crops Experiment Station grew twice as big and twice as numerous.

That aluminum foil put weeds out of commission, but even more important, it kept the soil cooler (as much as 20°), saved soil moisture, and discouraged insects.

In Florida, where growing summer vegetables is a discouraging job, the foil helped a different way. Plants sometimes die for lack of oxygen in water-logged soils after heavy summer rains. The foil kept these downpours from saturating the soil.

How much does it cost? The Reynolds Metals Co. of Richmond, Va. makes a garden mulch foil to sell at $14 per 25-pound roll 12 inches wide. You can get about 47 sq. ft. per pound of foil. (War may affect both price and availability.)

For small garden spots, the Reynolds people say that ordinary Frozen Food Wrap works successfully. You can buy it at just about any grocery store for about $1.75 per 50-ft. roll, 18 inches wide.

L. J. Roberts, a commercial asparagus grower in Delaware, says that with labor costs as they are, truck growers can hardly afford to hand-weed.

Commercial growers and home gardeners will find it best to work fertilizer into the soil before laying down the foil, Dr. F. T. McLean of the Virginia Truck Crops Experiment Station suggests.

You can walk on the foil safely without much danger of tearing it, he has found, or you can roll it up as you harvest the crop from the row.

The mulch boosted yields exceptionally for all garden crops in Virginia, and in Florida it helped make outstanding strawberry yields. How did they get new plants to root? By poking holes in the foil; at every spot a new plant took root.

—*Farm Journal*

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Vertical Farm Diversification—By D. Howard Doane, farm-management expert and contributor to farming magazines and journals. Here is an important book on farming which offers the farmer a route in the production of income which will carry his agricultural operations beyond the actual production of raw materials and into the field of distribution. In other words, Mr. Doane would have the farmer look toward "added income from Grading, Processing, Direct Selling". The reader will find *Vertical Farm Diversification* both stimulating and helpful reading. University of Oklahoma Press. 183 pages. $2.75.

Animal Science—By W. E. Ensminger, Chairman, Department of Animal Husbandry, Washington State College. In this livestock book, Dr. Ensminger brings together a wealth of information on the breeding, feeding, care and management of animals. *Animal Science* is a stockman's practical reference book covering beef cattle, sheep and goats, swine, horses and mules, with general sections on genetics and animal breeding, disease prevention, parasitic control, marketing, livestock barns, shelters and equipment. Excellent illustrations include especially fine drawings by R. F. Johnson, California Polytechnic Institute. The Interstate Printers and Publishers, Inc. 1020 pages. $6.00.

Swine Production—By W. E. Carroll and J. L. Krider, Professors of Animal Science, University of Illinois. This book is designed to promote the more profitable raising of hogs as either a major or a minor enterprise of successful farm operation. Both the establishment and the operation of the swine enterprise are described, with special emphasis on Breeding, Feeding, Management and Marketing factors as they affect costs and returns. Good practices are stressed throughout the book in their relation to profits. McGraw-Hill Book Company. 498 pages. $5.50.

Hunger Signs in Crops—A symposium, edited by Gove Hamboge—Revised Edition. This outstanding volume was prepared by a group of this country's well-known soil scientists. Beautiful color plates enable the reader to discover why any crop may not be doing well, as many so-called plant diseases are really "hunger signs"—symptoms of plant-food deficiencies. This book brings you, in practical form, knowledge of these symptoms in its 9 chapters of text and illustrations. Indispensable, whether you are a farmer, an agricultural worker, a home gardener, or a student. National Fertilizer Association. 370 pages. $4.50.

Milk and Milk Products—By Clarence Henry Eckles, Willes Barnes Combs, Professor of Dairy Husbandry and Harold Macy, Professor of Bacteriology, Univerity of Minnesota. We call attention to the new Fourth Edition of the Eckles, Combs and Macy text, *Milk and Milk Products*, which presents the latest information on the chemistry, bacteriology and microbiology of milk, on dairying processes, dairy testing and calculation, and on the manufacture of dairy products. This is a valuable text for students and all who are commercially engaged in the manufacture of milk and milk products. McGraw-Hill Book Company. 454 pages. $5.00.

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"If there is righteousness in the heart there will be beauty in the cha acter. If there be beauty in the character, there ill be harmony in the home. If there be harmony in the home, there will be order in the nation. When there is order in the nation, there will be peace in the world."

Chinese Proverb

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Lancaster, Pennsylvania